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METALS SUBCOMMITTEE REPORT - MANUFACTURING TECHNOLOGY ADVISORY --ETC(U)
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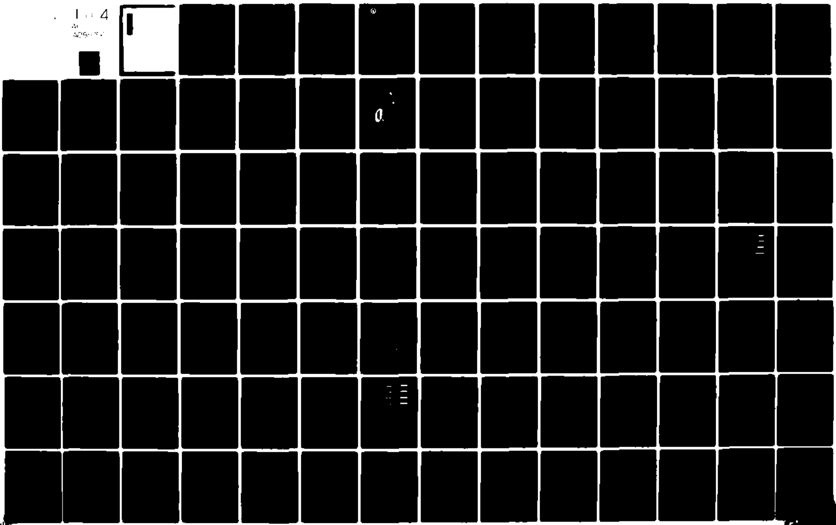

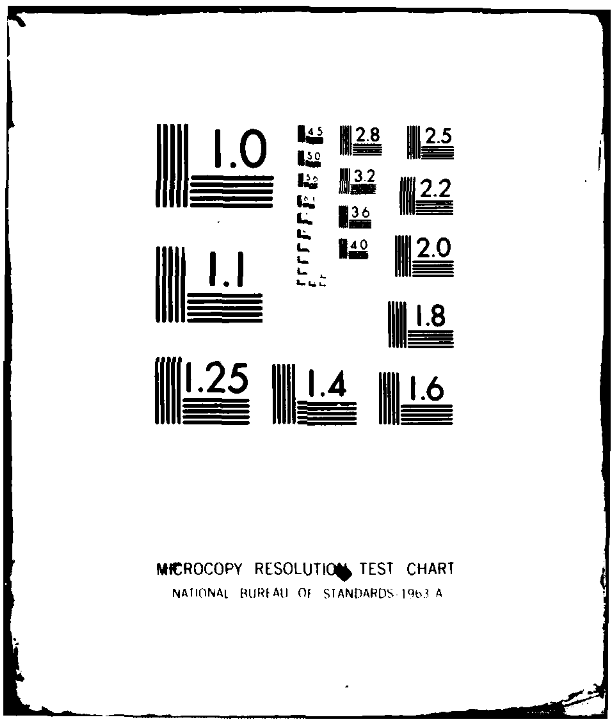
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DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT 3 Jun 80

SUBJECT: Metals Subcommittee Annual Report

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Inclosed is a copy of the Metals Subcommittee Annual Report for FY79. It describes the Subcommittee's activities for the year, planned activities for FY80 and gives an overview of the three Services' metals programs.

1 Incl
as

for GORDON B. NEY
Chairman,
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
This document summarizes the mission, organization, methodology and accomplishments of the Metals Subcommittee of MTAG. Program status: past, present and projected trends are outlined by process or technical objective.

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DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

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SUBJECT: Metals Subcommittee Report

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1. Reference is made to Charter, DOD Manufacturing Technology Advisory Group, paragraph V D 1 and 2.

2. This document contains the Metals Subcommittee Report for 1979, as required by reference 1. Within it are the Subcommittee's analysis and findings concerning the three services' Metals Manufacturing Technology Programs for FY80, FY81, and the Five Year Planning period of FY81 through FY85. Subcommittee tasks for 1980 and letters initiating action on these tasks are included in Appendix D.

3. This Report is a compilation of many individuals' work and reflects the spirit of cooperation that exists among the members of the subcommittee.

Gordon Ney
GORDON NEY
Chairman,
Metals Subcommittee

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INDEX

INTRODUCTION

- METALS SUBCOMMITTEE
- METALS PROGRAM FUNDING SUMMARY
- REVIEW OF METALS TECHNOLOGIES
- SUMMARY

THIS REPORT IS DIVIDED INTO FOUR PARTS. THE FIRST PART WILL DISCUSS THE METALS SUBCOMMITTEE. THE SECOND PART WILL PRESENT AN OVERVIEW OF FUNDING LEVELS FOR FY80, 81 AND BEYOND. A DISCUSSION OF THE MAJOR TECHNOLOGY AREAS WITHIN THE METALS PROGRAM WILL THEN FOLLOW. FINALLY, PAST AND FUTURE ACTIVITIES WILL BE SUMMARIZED.

OBJECTIVE

TO PROVIDE A FORUM FOR THE EXCHANGE OF TECHNICAL INFORMATION AND IDEAS DEALING WITH ADVANCED METAL PROCESSES AND TO OBTAIN THE MAXIMUM UTILIZATION OF THE FUNDS ALLOCATED TO ADVANCING THE PROCESSING OF METALS

THE METAL SUBCOMMITTEE SEES ITS OBJECTIVE AS PROVIDING A FORUM FOR THE EXCHANGE OF TECHNICAL INFORMATION AND IDEAS DEALING WITH ADVANCED METAL PROCESSES AND TO OBTAIN THE MAXIMUM UTILIZATION OF THE FUNDS ALLOCATED TO ADVANCING THE PROCESSING OF METALS. WE ARE ATTEMPTING TO PREVENT DUPLICATION, PROMOTE JOINT EFFORTS WHERE APPROPRIATE, AND STIMULATE THE APPLICATION OF ADVANCED TECHNOLOGY TO PROBLEM AREAS NOT PREVIOUSLY CONSIDERED.

AREA OF RESPONSIBILITY

THE METALS SUBCOMMITTEE DEALS WITH ALL PROCESSES REQUIRED TO PRODUCE METALS AND METAL PRODUCTS AND CERAMIC PRODUCTS

THE METALS SUBCOMMITTEE DEALS WITH ALL PROCESSES REQUIRED TO PRODUCE METALS, METAL PRODUCTS, AND CERAMIC PRODUCTS. THIS IS A VERY BROAD AREA; CONSEQUENTLY, WE CONCENTRATE ON THOSE TECHNOLOGIES THAT ARE COMMON, OR IN OUR OPINION, SHOULD BE COMMON AMONG THE SERVICES. BY CONCENTRATING ON THESE TECHNOLOGIES, WE ARE ABLE TO FAVORABLY INFLUENCE THE INDIVIDUAL SERVICE PROGRAMS IN A WAY THAT EACH SERVICE, WORKING BY THEMSELVES, CANNOT.

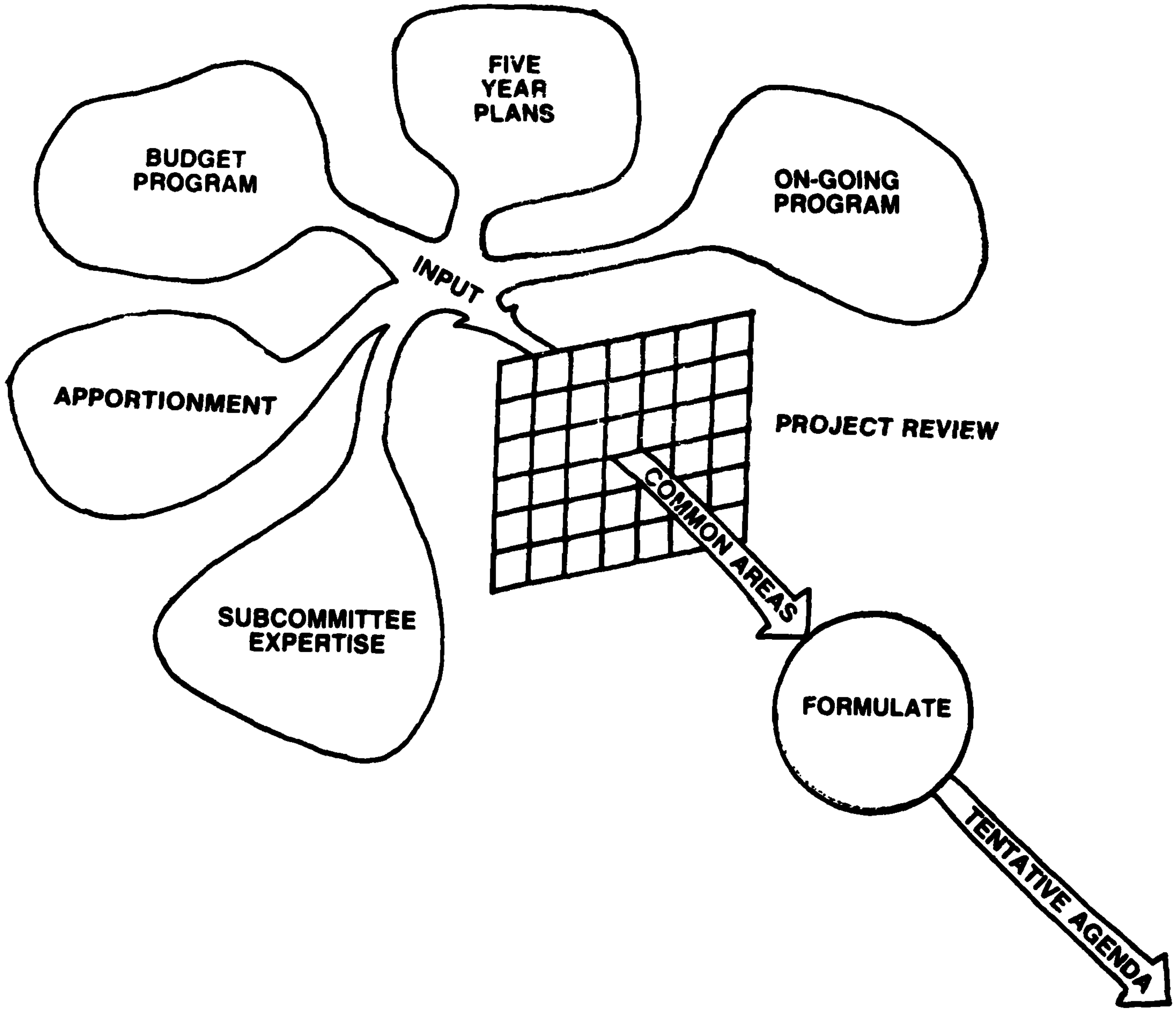
PROCESSES ASSOCIATED WITH MANUFACTURING CERAMIC PRODUCTS BECAME A NEW AREA OF RESPONSIBILITY OF THE METALS SUBCOMMITTEE THIS YEAR.

MEMBERSHIP

	PERSONNEL	ORGANIZATIONS
ARMY	16	12
NAVY	10	9
AIR FORCE	6	2
NASA	2	2
	34	25

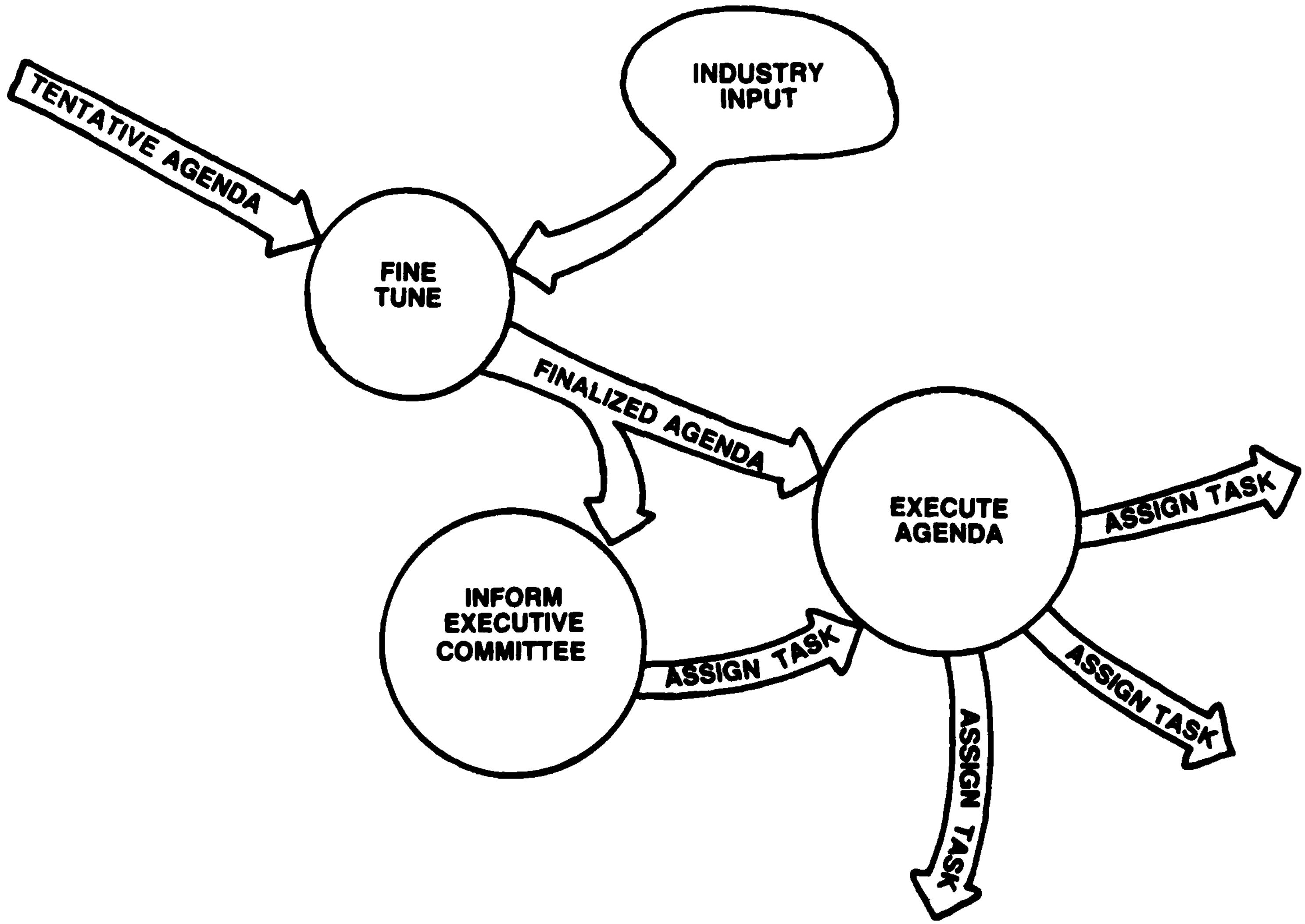
THE METALS SUBCOMMITIEE HAS 34 MEMBERS REPRESENTING 25 DIFFERENT ORGANIZATIONS. HOWEVER, SUBCOMMITTEE ACTIVITIES ARE NOT LIMITED TO MEMBERS ONLY. IN FACT, THE SUBCOMMITTEE FEELS IT IS IMPORTANT TO HAVE THE PROPER PEOPLE INVOLVED WHETHER THEY ARE MEMBERS OR NOT. AN ESTIMATED 300 INDIVIDUALS FROM GOVERNMENT AND INDUSTRY HAVE BEEN INVOLVED IN OUR ACTIVIES THIS YEAR.

OPERATIONAL PROCEDURE



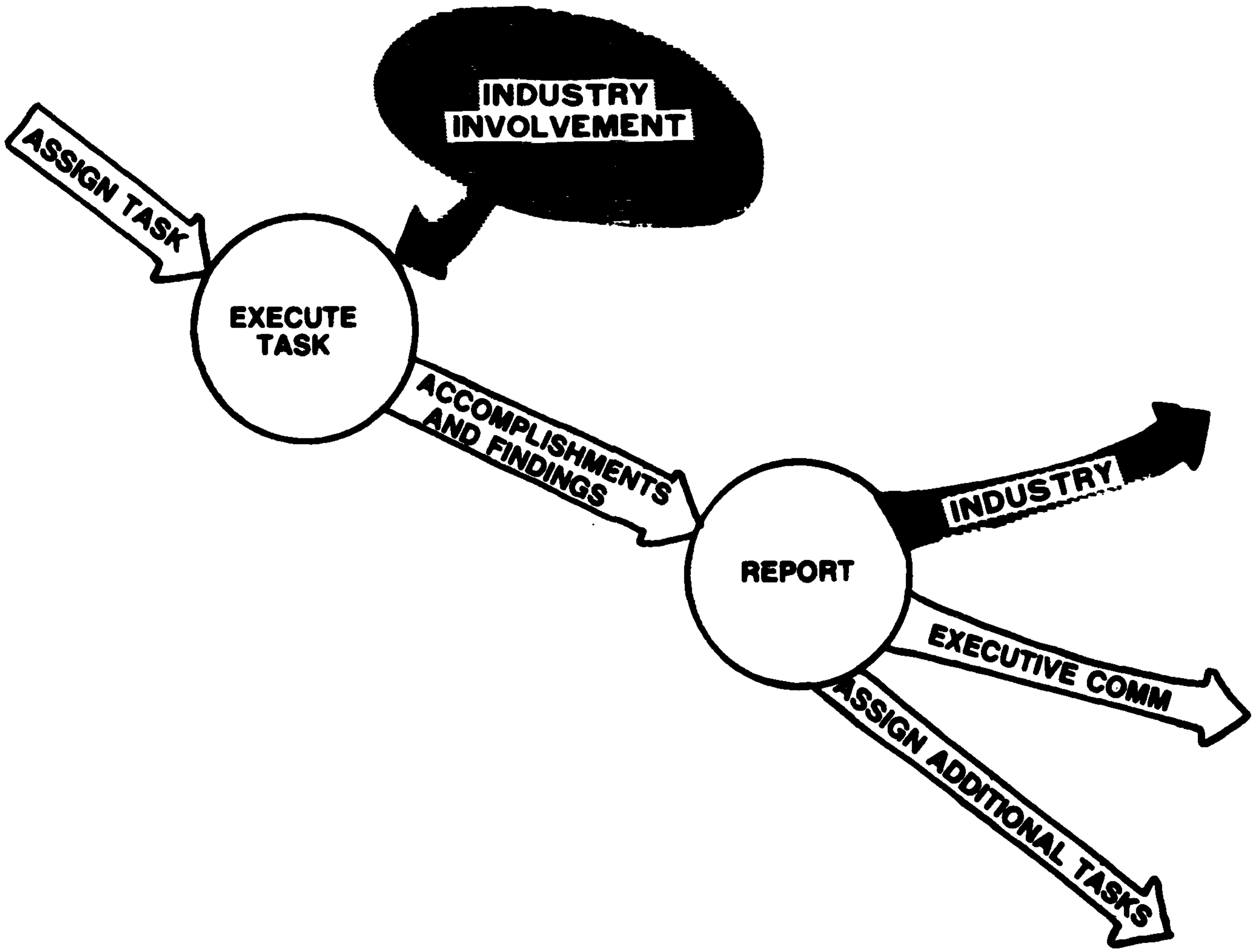
THIS CHART AND THE NEXT TWO CHARTS EXPLAIN THE OPERATIONAL PROCEDURE USED BY THE METALS SUBCOMMITTEE. IT BEGINS WITH INPUT THAT CONSISTS OF THE FIVE YEAR PLAN, THE BUDGET PROGRAM, THE CHANGES THAT HAVE OCCURRED TO LAST YEAR'S BUDGET DURING APPORTIONMENT, AND THE ON-GOING PROGRAM. USING THE EXPERTISE WITHIN THE SUBCOMMITTEE, THE PROJECT INFORMATION IS REVIEWED TO ASCERTAIN THE COMMON AREAS OR AREAS THOUGHT TO BE COMMON. FROM THE LIST OF COMMON AREAS, A PRELIMINARY PLAN FOR THE FOLLOWING YEAR IS FORMULATED. THE COMMON AREAS WHICH CAN BE MOST PROFITABLY INFLUENCED ARE THEN SELECTED; AND THE TASKS TO BE PERFORMED AND THE TIME FRAMES TO ACCOMPLISH THEM ARE DETERMINED. THIS BECOMES THE TENTATIVE AGENDA.

OPERATIONAL PROCEDURES



THIS AGENDA IS FINE TUNED AT THE ANNUAL MTAG MEETING. INDUSTRY INPUT AT THIS POINT IS CONSIDERED VITAL IN ORDER TO DETERMINE WHETHER THE TASKS ARE WORTHWHILE AND IF THERE ARE ANY IMPORTANT TASKS WHICH ARE NOT INCLUDED. WHEN THE AGENDA IS FINALIZED, THE EXECUTIVE COMMITTEE IS INFORMED. THEY MAY IN TURN MODIFY THE AGENDA BY EITHER ADDING OR DELETING TASKS. THE TASKS ARE THEN ASSIGNED TO VARIOUS SMALL GROUPS. TO MAKE THIS PROCESS WORK, AN ATTEMPT IS MADE TO ASSIGN THESE TASKS TO THE MOST APPROPRIATE INDIVIDUALS WITHIN THE SERVICES, WHETHER THEY ARE PART OF THE SUBCOMMITTEE OR NOT. IT IS IMPORTANT TO BRING TOGETHER THE MOST KNOWLEDGEABLE INDIVIDUALS IN EACH SERVICE TO ATTACK EACH SPECIFIC PROBLEM OR SET OF PROBLEMS.

OPERATIONAL PROCEDURES



ONCE THE TASKS HAVE BEEN ASSIGNED, THE GROUPS EXECUTE THEM. THEY ARE RESPONSIBLE FOR PLANNING ANY MEETINGS THAT MAY BE REQUIRED TO OBTAIN THE DESIRED RESULTS. INDUSTRY MAY BE INVOLVED IN EXECUTING THESE TASKS, DEPENDING ON THEIR NATURE. INDUSTRY, AS AN EXAMPLE, SHOULD NOT BE INVOLVED IN A TASK WHERE TWO OR MORE SERVICES ARE TRYING TO DETAIL THE WORKING ARRANGEMENTS FOR A SPECIFIC JOINTLY FUNDED EFFORT. ON THE OTHER HAND, INDUSTRY COULD PLAY A VITAL ROLE BY PROVIDING VALUABLE INPUT FOR CONSIDERATION IN PLANNING MULTI-SERVICE EFFORTS IN A BROAD TECHNOLOGY AREA.

ACCOMPLISHMENTS, FINDINGS, AND RECOMMENDATIONS RESULTING FROM EACH TASK ARE DOCUMENTED. THESE ARE PUT INTO A REPORT AND FORWARDED TO THE EXECUTIVE COMMITTEE AND INDUSTRY WHERE APPROPRIATE. WHEN ADDITIONAL TASKS ARE REQUIRED, THEY ARE ASSIGNED; AND THIS COMPLETES THE CYCLE.

PROJECT REVIEW

PURPOSE

TO REVIEW THE BUDGET AND APPORTIONMENT PROJECTS FOR DUPLICATION OF EFFORT AND POTENTIAL MULTI-SERVICE EFFORTS.

THE CORE OF THIS OPERATIONAL PROCEDURE IS THE PROJECT REVIEW. DURING THE SUMMER OF EACH YEAR, THE SUBCOMMITTEE MEETS TO REVIEW THE BUDGET AND APPORTIONMENT PROGRAMS OF THE THREE SERVICES. THE PURPOSE OF THIS MEETING IS TO IDENTIFY DUPLICATION OF EFFORT AND POTENTIAL MULTI-SERVICE EFFORTS.

AT OUR FIRST MEETING IN SEPTEMBER 74, WE ADOPTED A SYSTEMATIC APPROACH FOR IDENTIFYING POTENTIAL DUPLICATION OF EFFORT. BASICALLY, THIS APPROACH IS STILL USED TODAY.

PROJECT REVIEW

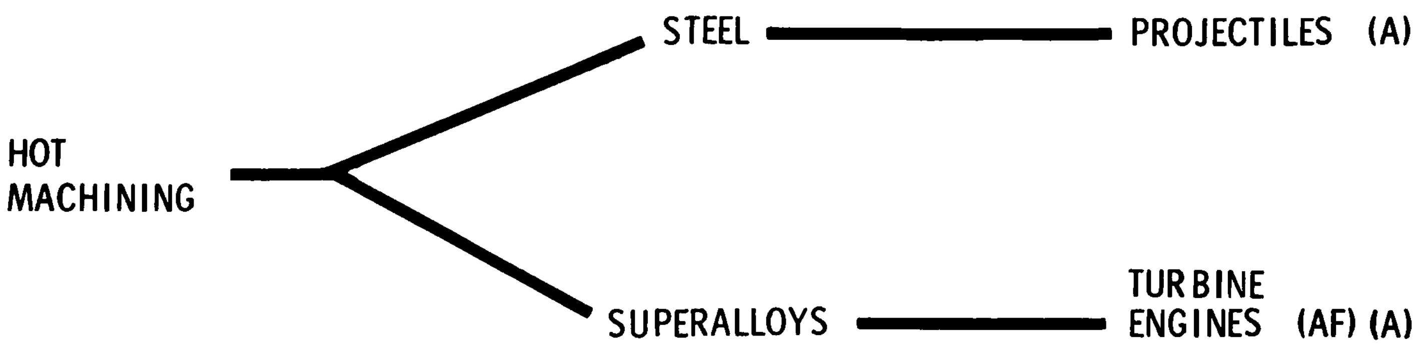
APPROACH

- DISCUSS PROJECTS
- CLASSIFY PROJECTS
  - PROCESS
  - MATERIAL
  - APPLICATION
- GROUP PROJECTS BY PROCESS
- DISCUSS THE SIMILARITIES AND DIFFERENCES AMONG THE EFFORTS
- RECOMMEND APPROPRIATE ACTIONS

IT CONSISTS OF FIVE STEPS. THE FIRST STEP IS TO DISCUSS EACH PROJECT SO THAT ALL SUBCOMMITTEE MEMBERS KNOW WHAT EACH SERVICE'S PROGRAM CONSISTS OF. THE NEXT STEP IS TO CLASSIFY THE PROJECTS ACCORDING TO THE PROCESS BEING ADDRESSED, THE MATERIAL BEING PROCESSED, AND THE APPLICATION OF THE PROCESS. THE THIRD STEP IS TO GROUP PROJECTS BY SIMILAR PROCESSES FOLLOWED BY A DISCUSSION OF THE SIMILARITIES AND DIFFERENCES AMONG THE SIMILARLY GROUPED PROJECTS. FROM THIS DISCUSSION, THE APPROPRIATE ACTION PLAN IS FORMULATED.

METAL REMOVAL

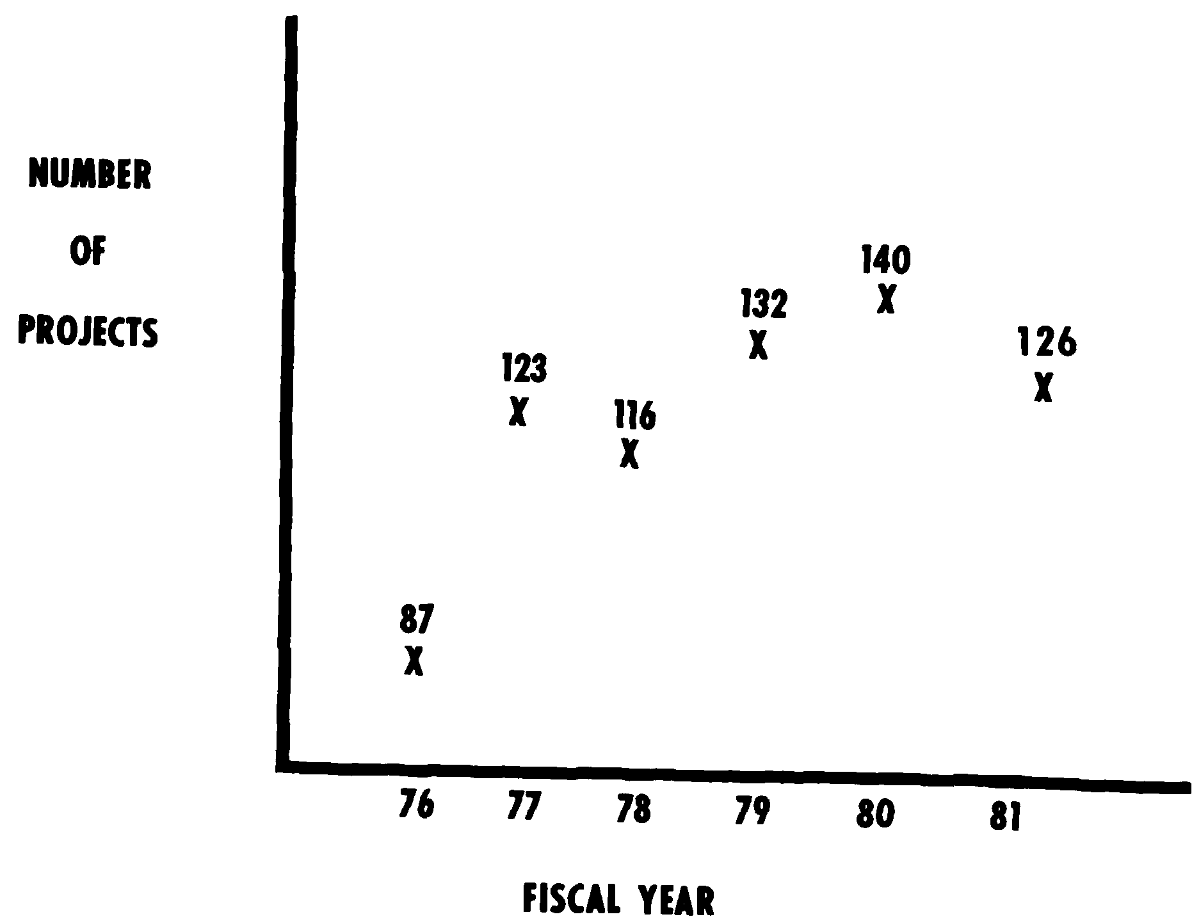
PROCESS | **MATERIAL** | **APPLICATION**



THIS CHART WILL BETTER ILLUSTRATE OUR APPROACH. IN THIS EXAMPLE, AFTER CLASSIFYING ALL THE PROJECTS ACCORDING TO THEIR PROCESS, MATERIAL AND APPLICATION, WE FOUND THAT HOT MACHINING WAS BEING PURSUED BY BOTH THE ARMY AND AIR FORCE. FROM OUR DISCUSSIONS, WE FOUND THAT THE ARMY'S STEEL PROJECTILE WORK IS USING A PLASMA TORCH AS THE HEAT SOURCE WHEREAS THE ARMY'S AND AIR FORCE'S SUPERALLOY WORK WOULD USE A LASER AS THE HEAT SOURCE. WE CONCLUDED THAT THERE WAS NO DUPLICATION BETWEEN THE STEEL AND SUPERALLOY EFFORTS. HOWEVER, A POTENTIAL DUPLICATION EXISTS BETWEEN THE ARMY AND AIR FORCE SUPERALLOY WORK. BOTH WILL USE LASERS AND BOTH ARE AIMED AT TURBINE ENGINE COMPONENTS. THEREFORE, OUR RECOMMENDATION IS FOR THE SPONSORS OF THESE PROGRAMS TO MEET AND FORMULATE A MULTI-SERVICE PROGRAM. THIS WILL ENSURE THAT NO DUPLICATION TAKES PLACE.

PROJECT REVIEW

WORK LOAD



WHILE OUR APPROACH TO THE PROJECT REVIEWS HAS NOT CHANGED, OUR METHODS HAVE. WE HAVE HAD TO IMPROVE OUR METHODS BECAUSE THE NUMBER OF PROJECTS REVIEWED HAS INCREASED SUBSTANTIALLY OVER THE YEARS. THIS INCREASE HAS LED TO GREATER PROBLEMS IN MAINTAINING ACCURATE DATA AND ASSURING ADEQUATE COVERAGE.

PROJECT REVIEW

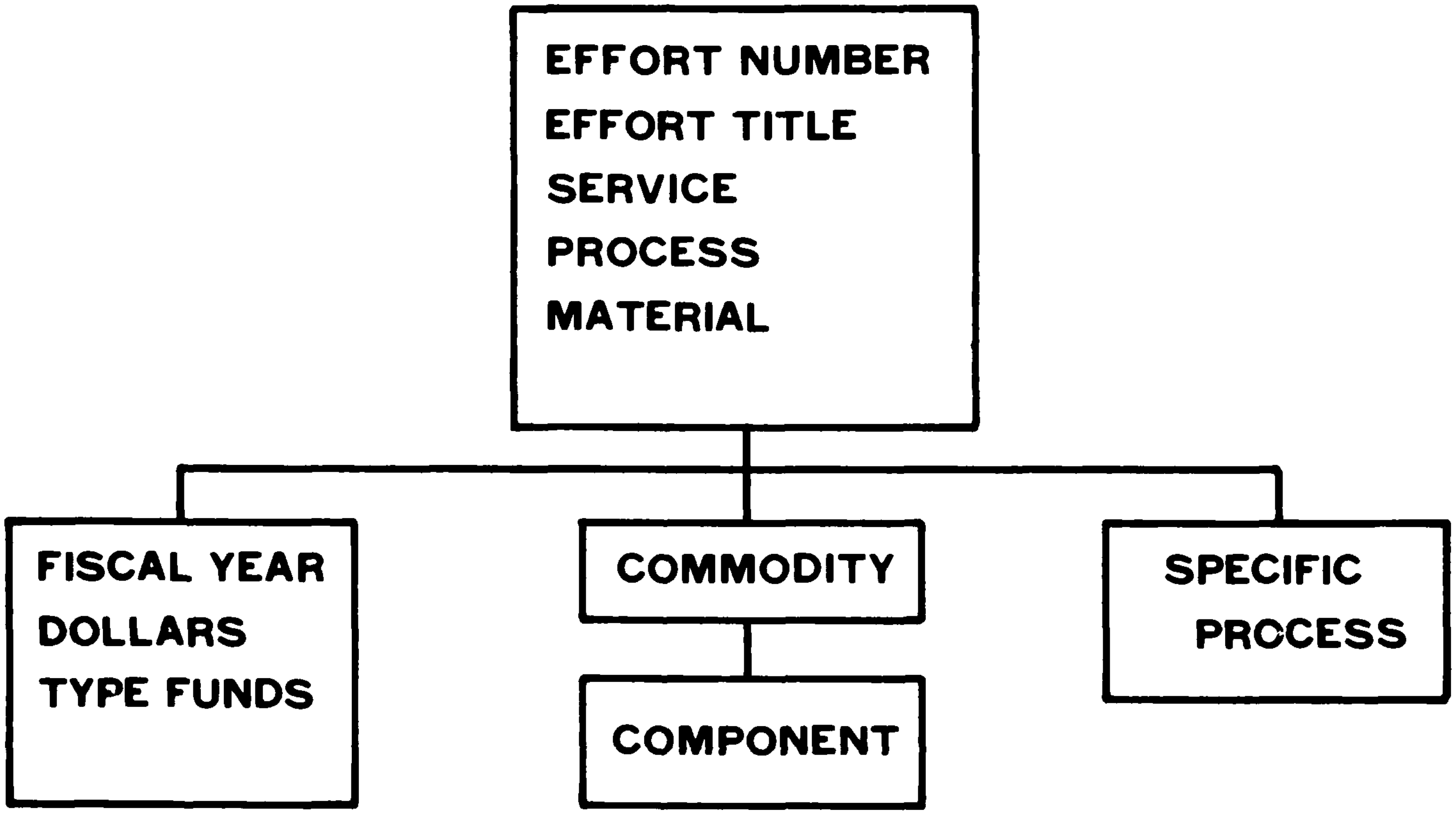
METHODS IMPROVEMENT

- EXPERIMENTED WITH USING AUTOMATED DATA BASE FOR THE FY80 BUDGET PROGRAM
- EXPANDED THE SYSTEM TO INCLUDE BUDGET, APPORTIONMENT AND ACTIVE PROJECTS

THEREFORE, ONE OF THE IMPROVEMENTS IS THE USE OF AUTOMATED DATA PROCESSING. THIS HAS HELPED US TO DO A MORE COMPLETE AND THOROUGH JOB OF IDENTIFYING POTENTIAL DUPLICATION. WE FIRST EXPERIMENTED WITH AUTOMATED DATA PROCESSING WHEN WE ESTABLISHED A COMPUTERIZED DATA BASE FOR THE FY80 BUDGET PROGRAM. THIS EXPERIMENT WORKED SO WELL, THAT DURING CY79 WE EXPANDED THE DATA BASE TO INCLUDE THE BUDGET, APPORTIONMENT AND FUNDED PROGRAMS WHICH ARE CURRENTLY ON-GOING.

PROJECT REVIEW

DATA BASE STRUCTURE



THE DATA BASE IS STRUCTURED AS SHOWN HERE, USING SYSTEM 2000, AN M.R.I. DATA BASE MANAGEMENT SYSTEM. IT IS A RELATIVELY SIMPLE STRUCTURE CONTAINING THREE LEVELS. THE FIRST LEVEL CONTAINS DATA PERTINENT TO THE EFFORT. THE PROCESS AND MATERIAL ENTRIES ARE SELECTED FROM A LIST AND INCLUDE PROCESSES SUCH AS FORGING, CASTING AND POWDER METALLURGY, AND MATERIALS SUCH AS STEEL, TITANIUM AND ALUMINUM. THE SECOND LEVEL HAS THREE MAIN DATA SECTIONS. THESE DATA SECTIONS DEAL WITH FUNDING, THE SPECIFIC PROCESSES BEING PURSUED AND THE COMMODITY TO WHICH IT IS BEING APPLIED. THE SPECIFIC PROCESSES ARE FREE FORMATTED IN THE SENSE THAT THEY ARE NOT SELECTED FROM A PREDETERMINED LIST. THE COMMODITY ENTRIES ARE SELECTED FROM A LIST WHICH CONSISTS OF ENTRIES SUCH AS SHIPS, AIRCRAFT AND WEAPONS. THE THIRD LEVEL, COMPONENTS, STEMS FROM THE COMMODITIES SUPPORTED AND ARE ALSO FREE FORMATTED.

WE CURRENTLY HAVE 325 EFFORTS WORTH 200 MILLION DOLLARS ACCOUNTED FOR IN OUR DATA BASE.

PROJECT REVIEW

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7322	ARMY	81 82 83		LOW COST TRANSPIRATION-COOLED COMBUSTOR LINER

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES COMBUSTOR	BONDING,DIFFUSION ETCHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M205	AIR FORCE	80 81 82		MT FOR ADVANCED VANE AND COMBUSTOR FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	MISSILES	TURBINE ENGINES COMBUSTOR VANES	BONDING,DIFFUSION ETCHING

THIS DATA BASE SYSTEM IS USED TO SORT PROJECTS BY THEIR PROCESS, MATERIAL AND APPLICATION AND PRINT SELECTED DATA ELEMENTS IN THE FORMAT SHOWN. THE TWO PROJECTS SHOWN HERE ARE CONCERNED WITH APPLYING DIFFUSION BONDING TECHNOLOGY TO TRANSPIRATION COOLED TURBINE ENGINE COMPONENTS. THE PROJECTS REPRESENT A POTENTIAL JOINTLY FUNDED EFFORT BETWEEN THE ARMY AND AIR FORCE.

POWDER METALLURGY

FREQUENCY	SPECIFIC PROCESS AREA
1	EXTRUSION PREFORMS
12	HOT ISOSTATIC PRESSING
1	ISOSTATIC PRESSING
1	ISOTHERMAL FORGING
1	OTHER (PM APPROACH)
3	PM FORGING
1	PREP
2	PRESS AND SINTER
2	POWDER MANUFACTURE
1	PRESSING, VACUUM HOT

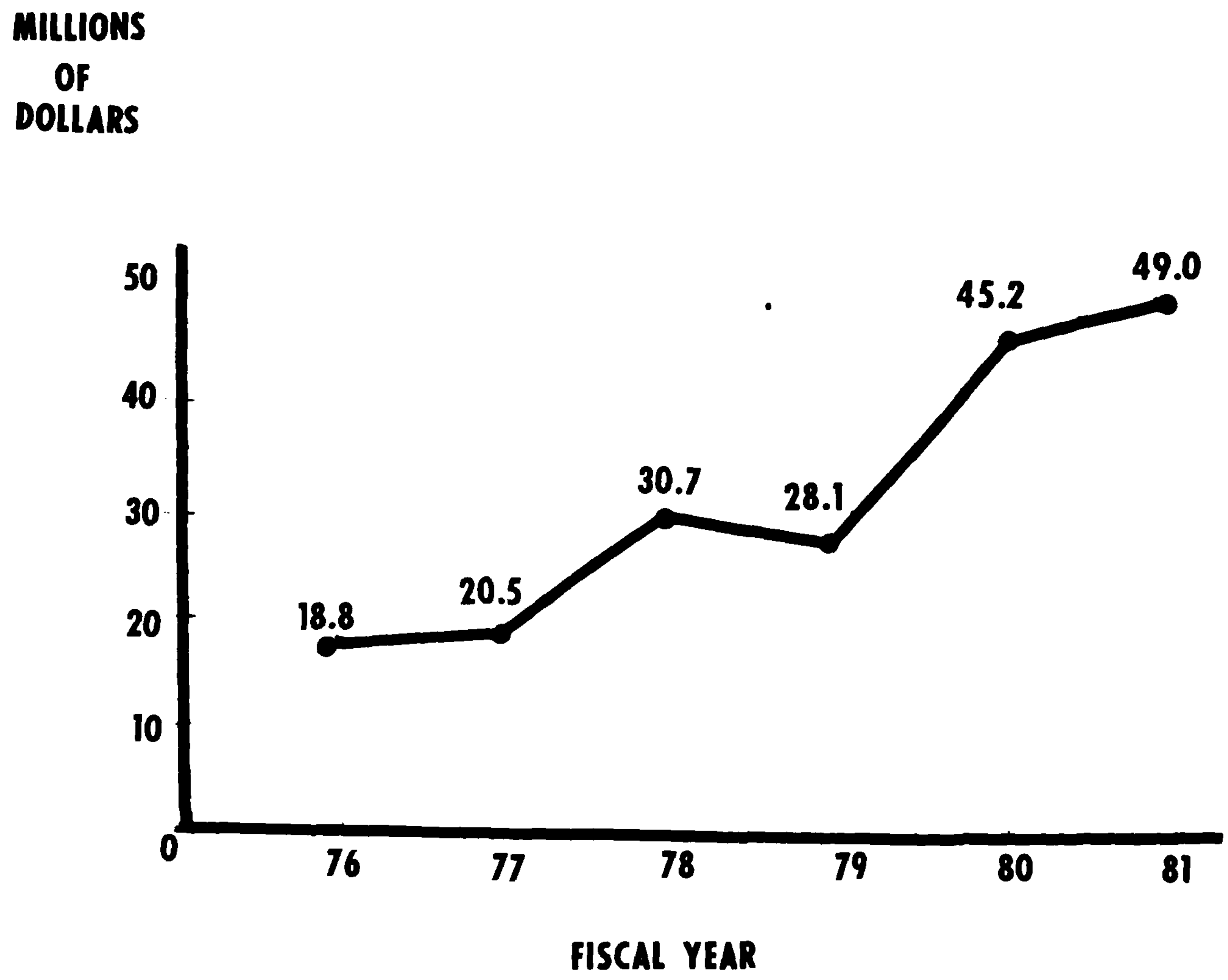
ANOTHER MEANS BY WHICH THIS DATA BASE CAN BE USED TO HELP DETERMINE POTENTIAL DUPLICATION OF EFFORT IS TO IDENTIFY THE NUMBER OF EFFORTS WHICH DEAL WITH A SPECIFIC PROCESS. AN EXAMPLE OF THIS DATA IS SHOWN HERE FOR POWDER METALLURGY. WHEN THIS DATA IS COUPLED WITH DATA PRESENTED IN THE PREVIOUS CHART, IT IS A VERY POWERFUL TOOL TO AID IN DETERMINING POTENTIAL DUPLICATION OF EFFORT.

METALS PROGRAM FUNDING SUMMARY

- HISTORICAL TRENDS
- CURRENT BUDGET PROGRAM ANALYSIS
- FUTURE PROJECTIONS

THE SECOND PART OF THIS REPORT PROVIDES THE METALS PROGRAM DATA FUNDING SUMMARY. THE TYPES OF DATA AND ANALYSES PROVIDED FALL INTO THE CATEGORIES OF HISTORICAL TRENDS, CURRENT BUDGET PROGRAM ANALYSES AND FUTURE PROJECTIONS.

FUNDING HISTORY



THIS CHART SHOWS THE GROWTH THAT HAS TAKEN PLACE IN THE METALS PROGRAM. ONE CAN SEE THAT THE PROGRAM HAS MORE THAN DOUBLED IN SIZE SINCE FY76. IT HAS GROWN FROM APPROXIMATELY 20 MILLION IN FY76 TO 49 MILLION IN FY81.

SUMMARY OF FY80 PROGRAM CHANGES

	FY 80BUDGET ESTIMATE		CURRENT FY80 PROGRAM	
ARMY	(61)	17,138	(59)	16,614
NAVY	(24)	11,566	(17)	7,690
AIR FORCE	(55)	23,326	(47)	20,865
TOTAL	(140)	52,030	(123)	45,169

NOW LET ME DISCUSS THE FUNDING PICTURE FOR FY80, FY81 AND BEYOND. THIS CHART SHOWS THE CHANGES THAT HAVE TAKEN PLACE IN THE FY80 PROGRAM. THERE HAS BEEN A DECREASE IN THE PROGRAM OF 7 MILLION DOLLARS. MOST OF THIS DECREASE IS ACCOUNTED FOR BY THE CUT IN FUNDS SUSTAINED BY THE NAVY.

SUMMARY OF FY81 METALS PROGRAM

	NUMBER OF PROJECTS	VALUE IN THOUSANDS
ARMY	66	17,616
NAVY	21	12,500
AIR FORCE	39	18,893
	126	49,009

THE FY81 METALS PROGRAM IS MADE UP OF 126 PROJECTS WORTH 49 MILLION DOLLARS. THE ARMY HAS 66 PROJECTS WORTH 17.5 MILLION DOLLARS; THE NAVY HAS 21 PROJECTS WORTH 12.5 MILLION; AND THE AIR FORCE HAS 39 PROJECTS WORTH 19.

FY81 METALS PROGRAM DISTRIBUTIONS

COMMODITY/SERVICE

	ARMY	NAVY	AIR FORCE	TOTAL
AIRCRAFT	6.1	13.2	28.3	47.6
MISSILES	1.9	0	8.4	10.3
SHIPS	0	8.4	0	8.4
WEAPONS	10.0	0	0	10.0
AMMUNITION	6.8	2.6	4.9	14.3
LAND VEHICLES	8.6	0	0	8.6
SUPPORT EQUIPMENT	.8	0	0	.8
TOTAL	34.2	24.2	41.6	100.0

THERE ARE THREE MAIN COMPONENTS OF THE MANUFACTURING TECHNOLOGY PROGRAM - THE SERVICE SUPPORTING THE WORK, THE TECHNOLOGY BEING EXPLOITED, AND THE COMMODITY TO WHICH IT IS BEING APPLIED. THE NEXT THREE CHARTS SHOW THE PERCENTAGE BREAK-OUT OF THE METALS PROGRAM BY THESE COMPONENTS.

SHOWN HERE IS THE BREAK-OUT BY COMMODITY AND SERVICE. THE SIGNIFICANT CHANGE OVER LAST YEARS' FIGURES IS THAT AIRCRAFT HAS BEEN SIGNIFICANTLY REDUCED BY 7.5 PERCENTAGE POINTS. THE OTHER COMMODITIES HAVE BEEN INCREASED SLIGHTLY WITH AMMUNITION AND WEAPONS INCREASING THE MOST.

FY81 METALS PROGRAM DISTRIBUTIONS

TECHNOLOGY/SERVICE

	ARMY	NAVY	AIR FORCE	TOTAL
FORGING	6.5	1.6	3.5	11.6
CASTING	2.4	5.9	4.7	13.0
POWDER METALLURGY	.7	2.4	8.7	11.8
EXTRUSION & ROLLING	1.2	0	2.0	3.2
METAL REMOVAL	12.5	.6	5.4	18.5
JOINING	3.5	3.9	5.9	13.3
SURFACE TREATMENT	4.4	4.1	3.5	12.0
FORMING	1.3	5.3	6.1	12.7
OTHER	1.7	.4	1.8	3.9
TOTAL	34.2	24.2	41.6	100.0

THIS CHART SHOWS THE PROGRAM BROKEN-OUT BY TECHNOLOGY AND SERVICE. SURFACE TREATMENT HAS SIGNIFICANTLY INCREASED OVER WHAT IT HAS BEEN IN THE PAST. SMALL CHANGES HAVE OCCURRED IN THE OTHER TECHNOLOGIES.

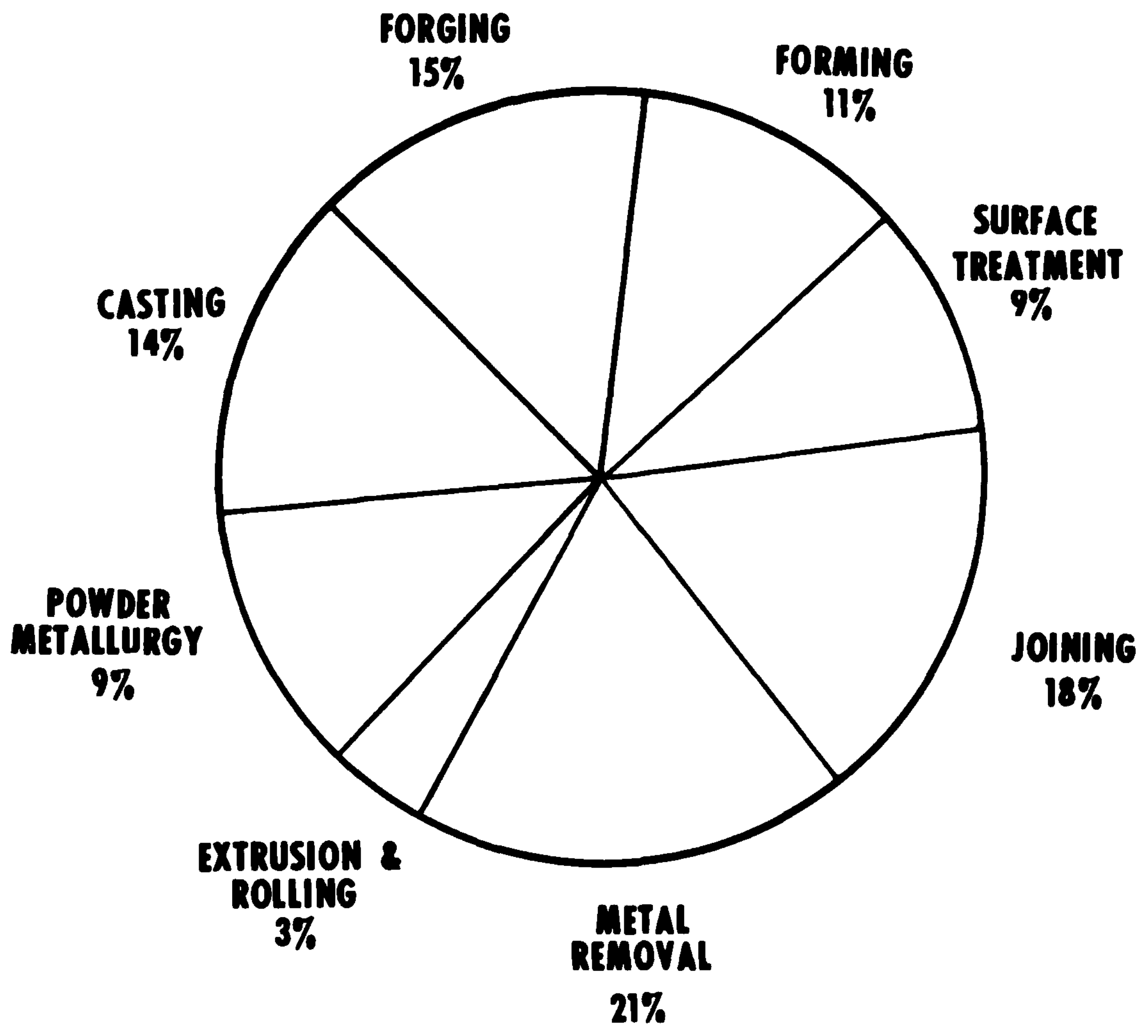
FY81 METALS PROGRAM DISTRIBUTIONS

COMMODITY/TECHNOLOGY

	FORGING	CASTING	POWDER METALLURGY	EXTRUSION & ROLLING	METAL REMOVAL	JOINING	SURFACE TREATMENT	FORMING	OTHER	TOTAL
AIRCRAFT	3.1	7.4	10.5	1.7	7.0	6.0	6.7	4.2	1.0	47.6
MISSILES	1.4	4.2	0	0	1.6	.6	0	1.8	.7	10.3
SHIPS	0	0	0	0	0	2.6	1.4	3.9	.5	8.4
WEAPONS	0	.3	.7	0	6.1	.4	2.5	0	0	10.0
AMMUNITION	6.4	0	.6	1.5	.4	2.4	.6	2.4	0	14.3
LAND VEHICLES	.7	1.1	0	0	3.4	1.3	.8	.4	.9	8.6
SUPPORT EQUIPMENT	0	0	0	0	0	0	0	0	.8	0
TOTAL	11.6	13.0	11.8	3.2	18.5	13.3	12.0	12.7	3.9	100

THE LAST BREAK-OUT IS BY COMMODITY AND TECHNOLOGY. THE ONLY COMMODITY WHERE ALL TECHNOLOGIES ARE BEING PURSUED IS AIRCRAFT. EXCEPT IN THE CASE OF FORGING, THE LARGEST PERCENTAGE OF EXPENDITURES IN EACH TECHNOLOGY OCCURS IN AIRCRAFT. METAL REMOVAL IS THE TECHNOLOGY WITH THE LARGEST PERCENTAGE OF EXPENDITURES.

SUMMARY OF FIVE YEAR PLAN

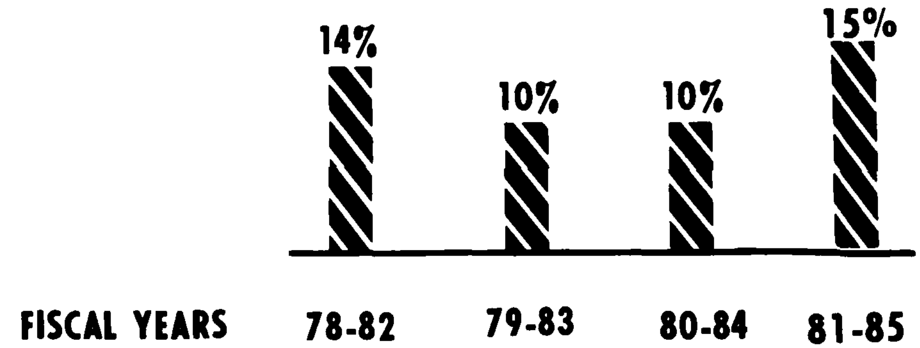


OUR ANALYSIS OF THE THREE SERVICES' FIVE YEAR PLANS REVEALS THAT APPROXIMATELY 240 MILLION DOLLARS WILL BE EXPENDED FOR METALS PROCESSING IN THE NEXT FIVE YEARS. THE FUNDS WILL BE DIVIDED AMONG THE MAJOR PROCESSING AREAS AS SHOWN HERE.

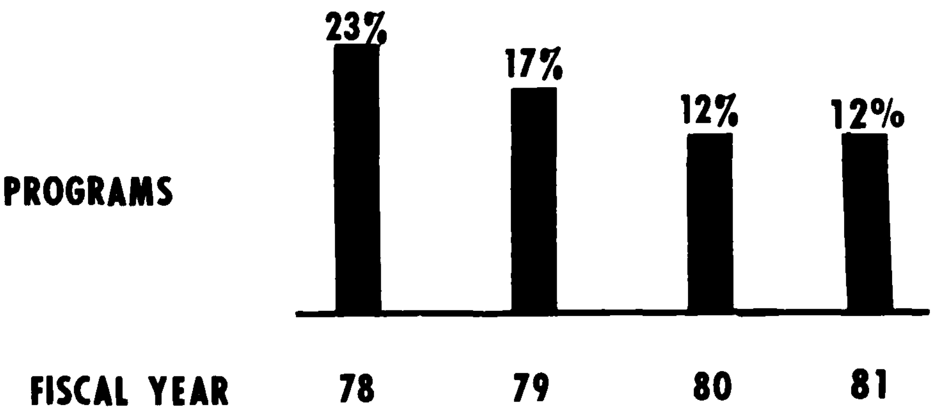
FORGING

FIVE YEAR FUNDING FORECAST ● 34-38 MILLION

COMPARISON OF FIVE YEAR PLANS



COMPARISON OF INDIVIDUAL YEAR PROGRAMS



IN THE FORGING AREA, WE ARE PROJECTING FIVE YEAR EXPENDITURES OF BETWEEN 34-38 MILLION DOLLARS. THE FIVE YEAR PLAN COMPARISON PROJECTS AN INCREASE IN FORGING'S SHARE OF THE METALS PROGRAM WHILE THE COMPARISON OF INDIVIDUAL BUDGET YEAR PROGRAMS SHOWS THAT ITS SHARE IS THE SAME AS LAST YEAR. BASED UPON THESE FIGURES, IT APPEARS THAT A RENEWED INTEREST IN FORGING TECHNOLOGY HAS DEVELOPED AND THAT FORGING EXPENDITURES WILL INCREASE.

FORGING

TECHNICAL OBJECTIVES

- REDUCE THE "ART" FACTOR
- IMPROVE MATERIAL UTILIZATION
- REDUCE TOOLING COSTS
- MINIMIZE ENERGY USED

THE TECHNICAL OBJECTIVES BEING SOUGHT IN THE FORGING AREA ARE TO REDUCE THE ART FACTOR, IMPROVE MATERIAL UTILIZATION, REDUCE TOOLING COSTS, AND MINIMIZE THE ENERGY USED.

FORGING

FREQUENCY	SPECIFIC PROCESS
2	CAD/CAM DIE DESIGN
1	COINING
1	CONTROLLED DEFORMATION
1	FORGING, HEADER
1	FORGING, INTERNAL SHEAR
2	FORGING, ISOTHERMAL
5	FORGING, PRECISION
6	FORGING, ROTARY
1	FORGING, UPSET
1	FORGING, WARM
1	HEADING PRESS
1	MECHANICAL TREATMENTS
1	NOSING
1	PIERCING
1	PM FORGING
1	PUNCH CHANGES
1	SWAGING, TAPER

THE TYPES OF FORGING PROCESSES BEING PURSUED AND THE NUMBER OF PROJECTS PURSUING THOSE PROCESSES ARE SHOWN ON THIS CHART.

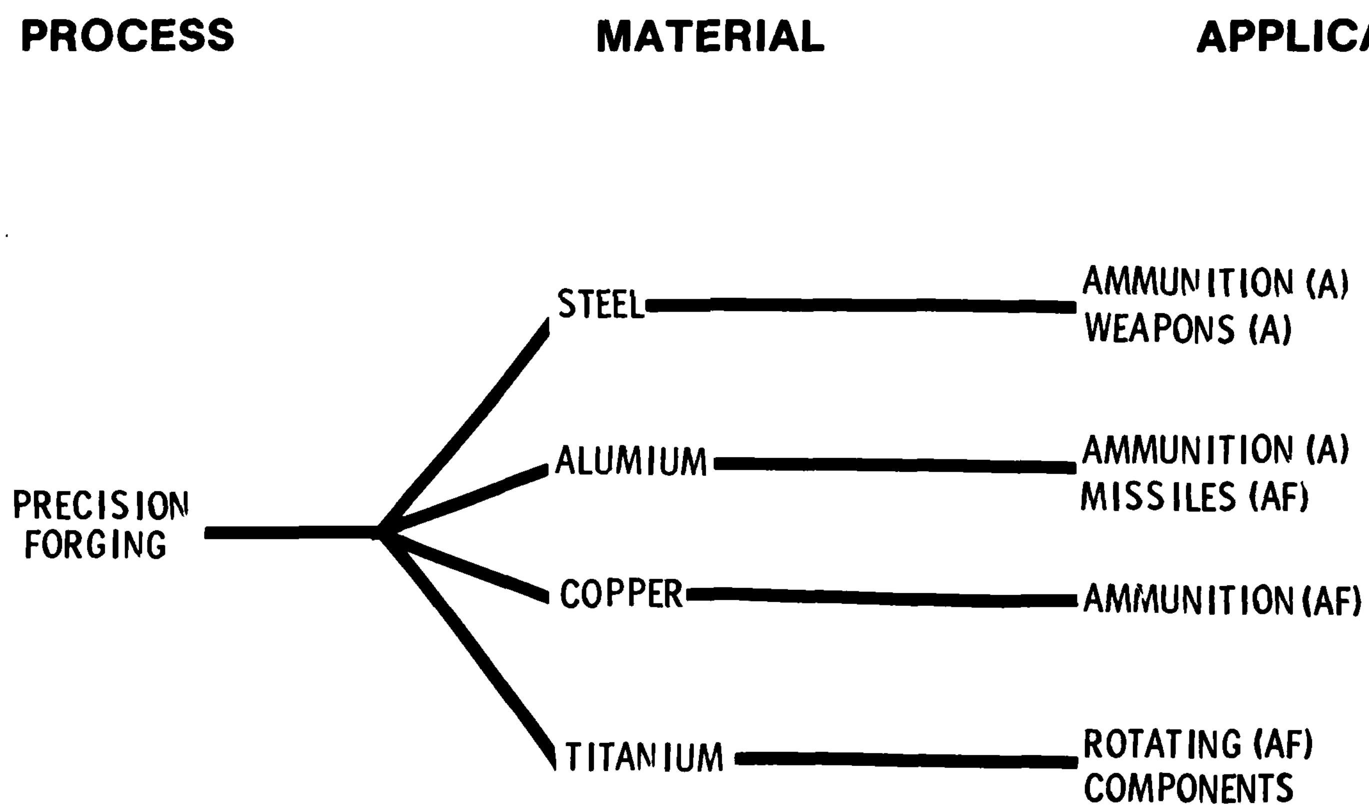
FORGING

FY81 PROGRAM REVIEW

- 15 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
    - PRECISION FORGING

THE SUBCOMMITTEE REVIEWED 15 FY81 PROJECTS. WE IDENTIFIED PRECISION FORGING AS A COMMON AREA AMONG THE SERVICES.

FORGING


PROCESS
MATERIAL
APPLICATION
PRECISION FORGING
STEEL
ALUMIUM
COPPER
TITANIUM
AMMUNITION (A)
WEAPONS (A)
AMMUNITION (A)
MISSILES (AF)
AMMUNITION (AF)
ROTATING (AF)
COMPONENTS

THE ARMY'S EFFORT IN PRECISION FORGING OF ALUMINUM IS DIRECTED AT HIGH VOLUME PARTS WHEREAS THE AIR FORCE IS ADDRESSING A SMALL NUMBER OF LARGE PLAN AREA PARTS (GREATER THAN 200 SQUARE INCHES) BY ISOTHERMAL TECHNIQUES. THEREFORE, WE CONCLUDED THERE IS NO DUPLICATION OF EFFORT.

FORGING

FY 80 PROGRAM CHANGES REVIEW

- 2 NEW PROJECT REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED TWO NEW FY80 PROJECTS AND FOUND NO NEW COMMON AREAS THAT HAD NOT BEEN ALREADY IDENTIFIED IN THE REVIEW OF THE FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT CONTAINS THE DATA FOR ALL ACTIVE, APPORTIONMENT AND BUDGET PROJECTS WHICH HAVE BEEN CLASSIFIED AS FORGING. THE PROJECTS ARE SORTED BY THE MATERIAL BEING FORGED AND ITS APPLICATION.

FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 8120	ARMY	75 74		IMPROVED HELICOPTER SKIN MATERIAL BY CONTROLLED SOLIDIFICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAME	THERMAL TREATMENTS MECHANICAL TREATMENTS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4309-10	ARMY	81		FORMING TAIL FIN FOR APFSDS PROJECTILE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	TAIL FINS	FORGING, PRECISION HEAT TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4309-11	ARMY	81		FORMING BOOM OF HEAT AMMO BY UPSET FORGING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	TAIL BOOM EXTENSION	FORGING, UPSET

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4184	ARMY	80		FORM SABOT SEGMENTS TO NET SHAPE ON APFSDS AMMO

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	SABOT	FORGING, PRECISION HEAT TREATMENT

FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
R 3204	ARMY	78		INTERNAL SHEAR FORGING FOR MISSILE PRIMARY STRUCTURE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	MISSILES	PRIMARY STRUCTURE STIFFENING RING SPLICE RING	FORGING, INTERNAL SHEAR

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M145	AIR FORCE	80 81	NU	MT FOR LARGE ALUMINUM PRECISION FORGINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	MISSILES	STRUCTURE	FORGING PRECISION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
08M128	AIR FORCE	81 80		MT FOR WAAM METAL PARTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
COPPER	AMMUNITION	ARMOR ANTI WIDE AREA	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00559	NAVY	79		PRODUCTION OF DU PENETRATORS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AMMUNITION	PROJECTILE, PENETRATOR	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4410	ARMY	77		MFG TUNGSTEN PENETRATORS TO SHAPE BY TAPER SWAGING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AMMUNITION	METAL PARTS PROJECTILE	SWAGING, TAPER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 6673	ARMY	73		PRECISION FORGING OF SPIRAL BEVEL GEAR

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TRANSMISSION GEARS	PRECISION CLOSED-DIE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4189	ARMY	82 80 81 79		HIGH FRAGMENTATION STEEL PRODUCTION PROCESS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	PROJECTILE BODY	FORGING, PRECISION HEAT TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4369	ARMY	81		TECHNIQUES TO IMPROVE PROJECTILE CAVITY QUALITY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	PROJECTILE CAVITY	MULT PREPARATION PUNCH CHANGES COINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4401	ARMY	81		HOT FORMING AND COLD HEADING OF FUZE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	FUZE	FORGING, WARM

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4309-12	ARMY	81		FORMING OF STUB BASE CARTRIDGE CASE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	STUB BASE CARTRIDGE CASE	FORGING, HEADER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 6759	ARMY	76 81		AUTOMATIC TRANSFER-HOT FORMING PRESSES FOR MORTAR AMMO

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	METAL PARTS MORTAR	HEADING PRESS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 6716	ARMY	79 77 76 81		DEVELOP COMPUTER-AIDED MODEL OF FORMING OPERATIONS FOR ARTILLERY MPTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	METAL PARTS	NOSING PIERCING DRAWING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 6681	ARMY	78		OPTIMIZE PARAMETERS FOR PROD FORMING OF PROJECTILES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	METAL PARTS PROJECTILES	FORGING, ROTARY CASTING, SQUEEZE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5024	ARMY	81 79 78		GEAR DIE DESIGN AND MFG UTILIZING COMPUTER TECHNOLOGY (CAM)

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	PROPULSION SYSTEM GEARS	CAD/CAM DIE DESIGN

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
Q 8053	ARMY	77		CAD/CAM FOR MANUFACTURE OF 3-DIMENSIONAL FORMS AND DIES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SUPPORT EQUIPMENT	PARACHUTE	CAD/CAM DIE DESIGN

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7586	ARMY	77		ROTARY FORGE INTEGRATED PRODUCTION TECHNOLOGY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	FORGING, ROTARY HEAT TREATMENT

FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7722	ARMY	77		IMPLEMENTATION OF THE 8 INCH XM201 ON ROTARY FORGE LINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	FORGING, ROTARY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7726	ARMY	79 78 77		APPLICATION OF COLD AND WARM FORGING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES, THIN WALLED	FORGING, ROTARY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7727	ARMY	79 77		RECYCLING OF SCRAP GUN TUBES BY ROTARY FORGING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	FORGING, ROTARY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7985	ARMY	80 79		SMALL ARMS WEAPONS NEW PROCESS PRODUCTION TECHNOLOY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CAL 50 THRU 40MM BARRELS	FORGING, ROTARY

FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M102	AIR FORCE	82 81		MF FOR THERMAL-MECHANICAL PROCESSING OF LOW COBALT ALLOYS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES	CONTROLLED DEFORMATION HEAT TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
92M252	AIR FORCE	79 81		MT FOR INTEGRAL ROTATING COMPONENTS BY ISOTHERMAL FORGING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	MISSILES	TURBINE ENGINES DISKS	FORGING, ISOTHERMAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00400	NAVY	80 81		RARE EARTH ADDITIONS TO TITANIUM ALLOYS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRCRAFT STRUCTURES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M122	AIR FORCE	81		LOW COST TITANIUM WROUGHT PRODUCTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT		

FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M233	AIR FORCE	80 79 77	NU	MT FOR PRODUCIBILITY OF HIGH TEMP TI ALLOY FRENCH CONNECTION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES DISKS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M231	AIR FORCE	77 78		MT FOR ISOTHERMAL FORGING FAN BLADES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES FAN BLADES	FORGING, ISOTHERMAL

FORGING

SUBCOMMITTEE ACCOMPLISHMENTS

- ESTABLISHED A JOINT ARMY/AIR FORCE PROGRAM FOR ISOTHERMAL FORGING OF INTEGRAL ROTATING COMPONENTS
- ESTABLISHED A JOINT NAVY/AIR FORCE PROGRAM FOR TTRIUM ADDITIONS TO TITANIUM

FUTURE SUBCOMMITTEE ACTIVITIES

- INVESTIGATE THE POSSIBILITY OF A JOINT NAVY/AIR FORCE PROGRAM FOR SCALE UP OF CORONA 5
- INVESTIGATE THE POSSIBILITY OF A JOINT NAVY/AIR FORCE PROGRAM ON NEW MANUFACTURING TECHNOLOGY FOR SMALL ARMS WEAPONS

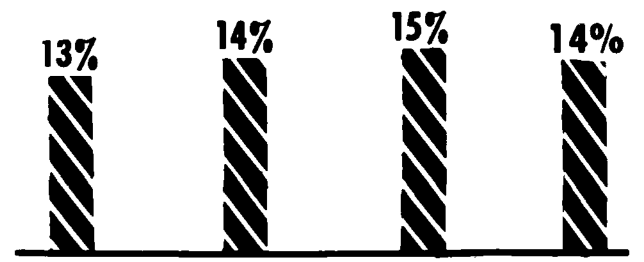
DURING THE PAST YEAR THE SUBCOMMITTEE HAS BEEN RESPONSIBLE FOR ESTABLISHING A JOINT ARMY/AIR FORCE PROGRAM FOR ISOTHERMAL FORGING OF INTEGRAL ROTATING COMPONENTS. ALSO, A JOINT NAVY/AIR FORCE PROGRAM FOR YTTRIUM ADDITIONS TO TITANIUM WAS ESTABLISHED.

IN THE NEXT YEAR, THE SUBCOMMITTEE WILL INVESTIGATE THE POSSIBILITY OF A JOINT NAVY/AIR FORCE PROGRAM FOR SCALE UP OF CORONA 5. ALSO, THE SUBCOMMITTEE WILL INVESTIGATE THE POSSIBILITY OF A JOINT ARMY/AIR FORCE PROGRAM ON NEW MANUFACTURING TECHNOLOGY FOR SMALL ARMS WEAPONS.

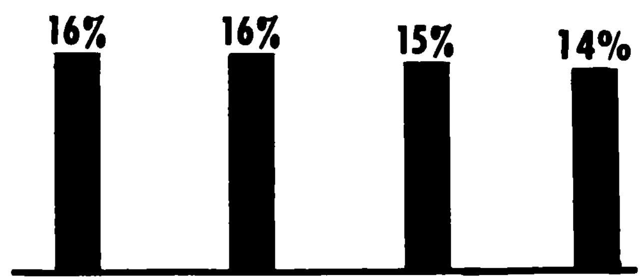
CASTING

FIVE YEAR FUNDING FORECAST ● **32-36 MILLION**

COMPARISON OF FIVE YEAR PLANS



COMPARISON OF INDIVIDUAL YEAR PROGRAMS



IN THE CASTING AREA, WE ARE PROJECTING FIVE YEAR EXPENDITURES OF BETWEEN 32 TO 36 MILLION DOLLARS. THE FIVE YEAR PLAN COMPARISON SHOWS A CONSTANT LEVEL OF EFFORT AS DOES THE INDIVIDUAL YEAR COMPARISONS. WE, THEREFORE, PROJECT THAT CASTING EFFORTS WILL CONTINUE TO REPRESENT ABOUT 15 PERCENT OF THE METALS PROGRAM.

CASTING

TECHNICAL OBJECTIVES

- REDUCE THE "ART" FACTOR
- REDUCE CASTING FACTOR
- REDUCE REJECTION RATE
- IMPROVE MATERIAL UTILIZATION
- INCREASE DEGREE OF AUTOMATION
- OBTAIN REALISTIC DESIGN ALLOWABLE DATA

THE TECHNICAL OBJECTIVES BEING SOUGHT IN THE CASTING AREA ARE TO REDUCE THE ART FACTOR, REDUCE THE CASTING FACTOR, REDUCE THE REJECTION RATE, IMPROVE MATERIAL UTILIZATION, INCREASE THE DEGREE OF AUTOMATION AND OBTAIN REALISTIC DESIGN ALLOWABLE DATA.

CASTING

FREQUENCY	SPECIFIC PROCESS
1	ALLOY MIXING
1	CADCAM MOLD DESIGN
8	CAST PLUS HIP
1	CASTING, CENTRIFUGAL
1	CASTING, DIE
1	CASTING, INVESTMENT
3	CASTING, PRECISION
1	CASTING, SQUEEZE
1	CASTING, THIN WALL
2	DATA GENERATION
1	DIRECTIONAL SOLIDIFICAT,
2	ESR
1	ESR SHAPED CASTINGS
1	EXOTHERMIC
1	INGOT SCALE UP
1	INNOCULANTS
1	NO-BAKE SANDS
1	RHEOCASTING
1	VAR
1	WITHDRAWAL

THE TYPES OF CASTING PROCESSES BEING PURSUED AND THE NUMBER OF PROJECTS PURSUING THOSE PROCESSES ARE SHOWN ON THIS CHART.

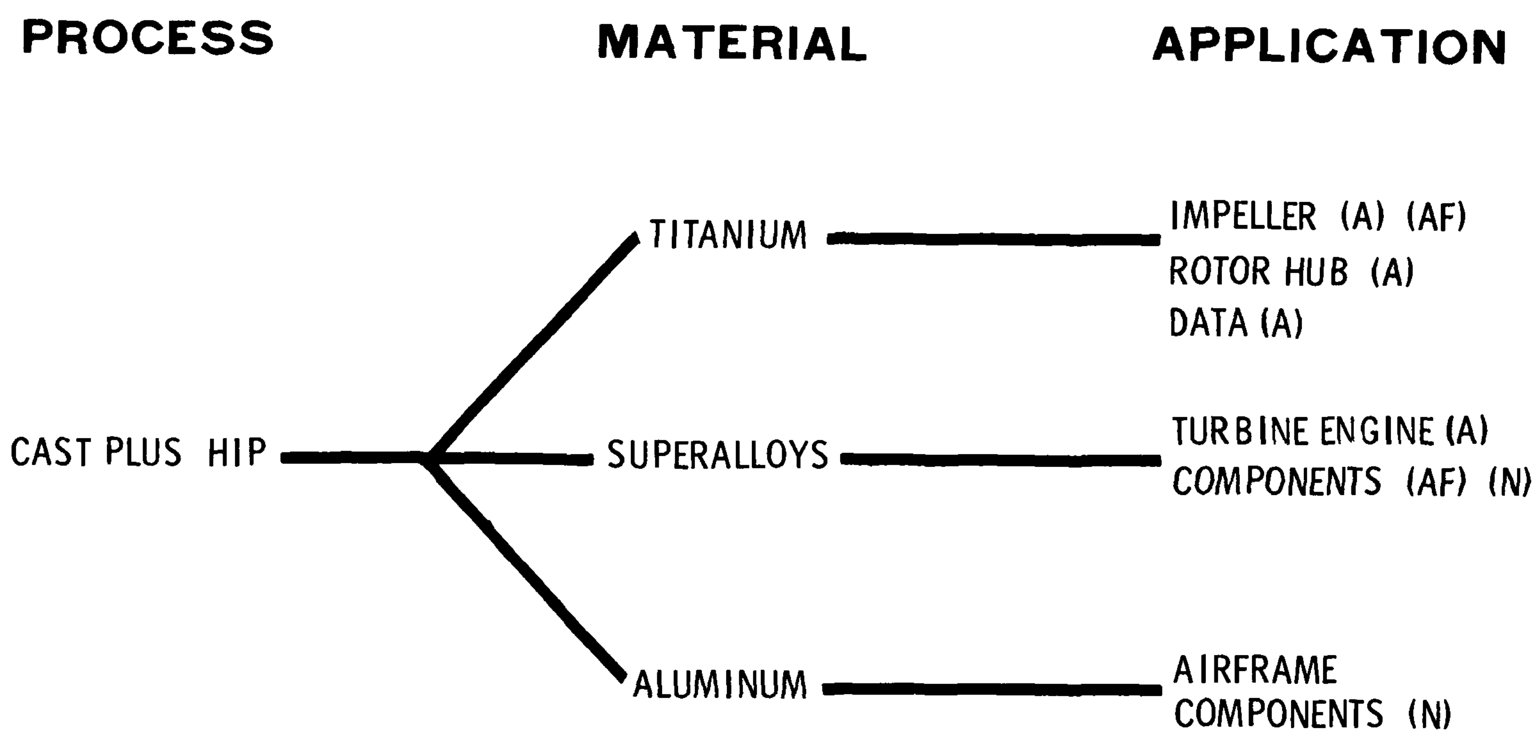
CASTING

FY 81 PROGRAM REVIEW

- 13 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - CAST PLUS HIP
  - PRECISION CASTING

THE SUBCOMMMITTEE REVIEWED 13 FY81 PROJECTS. WE IDENTIFIED CAST PLUS HIP AND PRECISION CASTING AS COMMON AREAS AMONG THE SERVICES.

CASTING

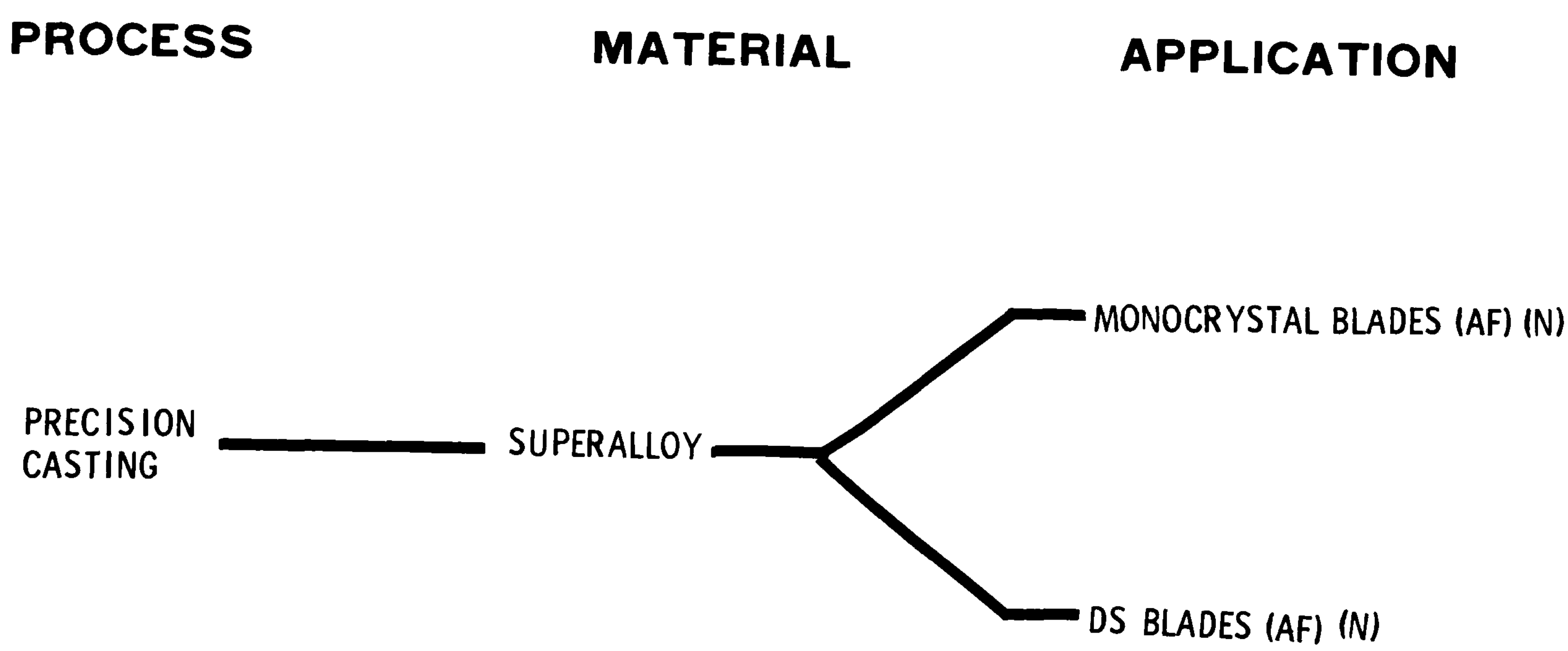

PROCESS
MATERIAL
APPLICATION
CAST PLUS HIP
TITANIUM
SUPERALLOYS
ALUMINUM
IMPELLER (A) (AF)
ROTOR HUB (A)
DATA (A)
TURBINE ENGINE (A)
COMPONENTS (AF) (N)
AIRFRAME
COMPONENTS (N)

THE ARMY AND AIR FORCE ARE JOINTLY PURSUING CAST PLUS HIP TECHNOLOGY FOR TURBINE ENGINE IMPELLERS. THE ARMY IS ALSO USING THIS TECHNOLOGY FOR HELICOPTER ROTOR HUBS WHICH ARE MUCH LARGER AND USE A DIFFERENT ALLOY. THE ARMY IS ALSO FUNDING AN EFFORT TO ESTABLISH A DESIGN DATA HANDBOOK FOR TITANIUM CAST PLUS HIP MATERIALS. THIS IS AN EFFORT THAT WAS RECOMMENDED BY INDUSTRY PARTICIPANTS AT THE METALS SUBCOMMITTEE'S CASTING SYMPOSIUM.

THE NAVY AND AIR FORCE ARE JOINTLY PURSUING CAST PLUS HIP TECHNOLOGY FOR PRODUCING PREMIUM QUALITY SUPERALLOY CASTINGS. THE ARMY'S FY81 PROGRAM PROPOSES TO EXTEND LOW CYCLE FATIGUE PROPERTIES OF THESE CASTINGS. THE THREE SERVICES WILL MEET DURING THE COMING YEAR TO MAKE SURE THAT THESE EFFORTS WILL NOT DUPLICATE ONE ANOTHER.

THE NAVY PROPOSES TO APPLY CAST PLUS HIP TECHNOLOGY TO ALUMINUM CASTINGS. THE AIR FORCE HAS EXPRESSED INTEREST IN THIS APPROACH AND MAY JOIN THE NAVY IN THIS PROGRAM.

CASTING


PROCESS
MATERIAL
APPLICATION
PRECISION CASTING
SUPERALLOY
MONOCRYSTAL BLADES (AF) (N)
DS BLADES (AF) (N)

THE NAVY AND AIR FORCE WILL INVESTIGATE THE POSSIBILITY OF JOINTLY FUNDING A PRECISION CASTING EFFORT FOR MONOCRYSTAL BLADES.

THE AIR FORCE ESTABLISHED THE RAM-DS PROCESS IN A PRIOR PROGRAM. THE NAVY WILL APPLY COMPUTER TECHNOLOGY TO THIS PROCESS TO PRODUCE AN ADAPTIVELY CONTROLLED PROCESS. THE SUBCOMMITTEE DETERMINED THAT NO DUPLICATION EXISTS.

CASTING

FY80 PROGRAM CHANGES REVIEW

- 8 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED EIGHT NEW FY80 PROJECTS AND FOUND NO NEW COMMON AREAS THAT HAD NOT BEEN ALREADY IDENTIFIED IN THE REVIEW OF THE FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT CONTAINS THE DATA FOR ALL ACTIVE, APPORTIONMENT, AND BUDGET PROJECTS WHICH HAVE BEEN CLASSIFIED AS CASTING. THE PROJECTS ARE SORTED BY THE MATERIAL BEING CAST AND ITS APPLICATION.

CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00744	NAVY	80	NU	HIP OF ALUMINUM CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAME PARTS	CAST PLUS HIP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91M167	AIR FORCE	80	NU	MT FOR PROCESS EFFECTS ON ALUMINUM CASTING ALLOWABLES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT MISSILES	STRUCTURES STRUCTURES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91M268	AIR FORCE	79		MT FOR PROCESS EFFECTS ON ALUMINUM ALLOWABLES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAME COMPONENTS	DATA GENERATION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 1903	ARMY	79 80		DIE CAST TAILCONE AND DESIGN MACHINE FOR BLU-96/B

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	BOMB TAIL CONE	CASTING, DIE

CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5080	ARMY	79 80		FABRICATION METHODS FOR HIGH STRENGTH NET SHAPE ALUMINUM TRANSMISSION CASES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	LAND VEHICLES	TRANSMISSION CASES	CAST PLUS HIP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M175	AIR FORCE	80 81	NU	MT FOR HIGH DUCTILITY ALUMINUM CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	MISSILES	STRUCTURES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M174	AIR FORCE	78 77 79		MT FOR WROUGHT FABRICATION METHODS FOR TI ALUMINIDE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AIRCRAFT	TURBINE ENGINES	INGOT SCALE UP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00673	NAVY	80	NU	BATTERY GRID CASTING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	SHIPS	BATTERIES SUBMARINES	

CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5006	ARMY	79 80		PRODUCTION OF LIGHTWEIGHT STEEL CAST TRACK SHOES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	TRACK SHOES	CASTING, THIN WALL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 4586	ARMY	79 80		IMPROVED LARGE ARMOR STEEL CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	TURRET	CONDUCTIVE SAND INNOCULANTS CHILLS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5002	ARMY	79 80		FABRICATING TORSION BAR SPRINGS FROM HIGH STRENGTH STEEL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	TORSION BARS	ESR VAR

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5092	ARMY	82 81		RHEOCAST PRESSURE CASTING FOR COMBAT VEHICLE PARTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	END CONNECTORS TRACK SHOES	RHEOCASTING THIXOFORGING

CASTING

```
***
                              YEARS OF
     EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*    T 5097      ARMY            78               INTEGRALLY CAST LOW COST COMPRESSOR
*                                77
*                                81

                  MATERIAL          APPLICATION         COMPONENT                    SPECIFIC PROCESS
***
*                 STEEL             LAND VEHICLES       TURBINE ENGINES              CAST PLUS HIP
*                                                       COMPRESSOR
--------------------------------------------------------------------------------------

                              YEARS OF
     EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*    T 5014      ARMY            78               FOUNDRY CASTING PROCESSES USING FLUID FLOW AND THERM ANAL
*                                77

                  MATERIAL          APPLICATION         COMPONENT                    SPECIFIC PROCESS
***
*                 STEEL             LAND VEHICLES       HULL/BODY                    CADCAM MOLD DESIGN
--------------------------------------------------------------------------------------

                              YEARS OF
     EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*    R 3231      ARMY            76               SQUEEZE CASTING

                  MATERIAL          APPLICATION         COMPONENT                    SPECIFIC PROCESS
***
*                 STEEL             MISSILES                                         CASTING, SQUEEZE
--------------------------------------------------------------------------------------

                              YEARS OF
     EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*    6 7605      ARMY            80               CHEMICALLY BONDED SAND FOR CLOSE TOLERANCE CASTING
*                                79

                  MATERIAL          APPLICATION         COMPONENT                    SPECIFIC PROCESS
***
*                 STEEL             WEAPONS             GUN MOUNTS                   MOLD MAKING
*                                                                                    NO-BAKE SANDS
--------------------------------------------------------------------------------------
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CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8050	ARMY	80		RECYCLING SPENT GUN TUBES BY ESR MELTING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	ESR

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8117	ARMY	81		SHAPED CASTINGS OF ESR STEEL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BREECH BLOCKS BREECH RINGS	ESR SHAPED CASTINGS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA81059	NAVY	81		CAM RAM-DS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES TURBINE BLADES	DIRECTIONAL SOLIDIFICAT.

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00746	NAVY	80		HIGH STRENGTH INCO 718 CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	IMPELLER	QUALITY CONTROL

CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M121	AIR FORCE	80 82		PREMIUN TURBINE WHEEL CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES STATIC COMPONENTS ROTATING COMPONENTS	CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7300	ARMY	81 82 83		IMPROVED LOW CYCLE FATIGUE CAST ROTORS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES ROTORS	CAST PLUS HIP HEAT TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA81062	NAVY	81		MONOCRYSTAL TURBINE AIRFOILS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE BLADES TURBINE ENGINES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M148	AIR FORCE	78 80 81	NU	MT FOR HP DS EUTECTIC BLADE FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADES	CASTING, INVESTMENT

CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M876	AIR FORCE	78		MT FOR AUTOMATION OF DIRECTIONAL SOLIDIFICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADES	EXOTHERMIC WITHDRAWAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
61M655	AIR FORCE	76 77		MT FOR DEVELOPMENT OF ADVANCED VANES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES NOZZLES VANES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
61M161	AIR FORCE	76 77 78		MT FOR HIGH INTEGRITY CASTING PROCESS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES	CAST PLUS HIP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M184	AIR FORCE	81 80 82	NO	MT FOR MONO CRYSTAL TURBINE BLADE SCALE-UP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	MISSILES	TURBINE ENGINES BLADE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
82M143	AIR FORCE	78		MT FOR HIGH INTEGRITY CAST DIFFUSER FOR SMALL ENGINES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	MISSILES	TURBINE ENGINES DIFFUSER	CASTING, PRECISION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00402	NAVY	81 80	NU	HIGH TOUGHNESS TITANIUM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	MICS HARDWARE	ALLOY MIXING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7241	ARMY	78 79 80 82		HOT ISOSTATIC PRESSED TITANIUM CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	ROTOR HUB	CAST PLUS HIP

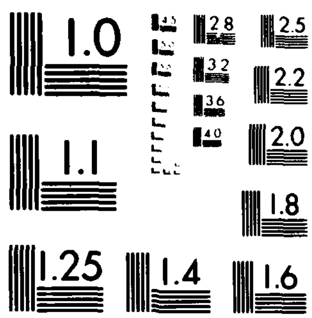
EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7285	ARMY	78 79 80 81		CAST TITANIUM COMPRESSOR IMPELLAR

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES COMPRESSOR IMPELLARS	CAST PLUS HIP

AD-A085 756 ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY ROCK ISLAND IL F/G 11/6
METALS SUBCOMMITTEE REPORT - MANUFACTURING TECHNOLOGY ADVISORY --ETC(U)
JAN 80 G NEY

UNCLASSIFIED NL

2 of 4



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

CASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7070	ARMY	75		CAST COMPRESSOR COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES COMPRESSOR	CAST PLUS HIP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7046	ARMY	77		PRECISION CAST TITANIUM COMPRESSOR CASING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES	CASTING, PRECISION CASTING, CENTRIFUGAL
		COMPRESSOR	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7362	ARMY	81 32		ENGINEERING DESIGN HANDBOOK FOR TITANIUM CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES AIRFRAME COMPONENTS	DATA GENERATION
	MISSILES	AIRFRAME COMPONENTS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M163	AIR FORCE	80 81	NU	MT FOP LARGE TITANIUM INLET CASTINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	MISSILES	STRUCTURES	PRECISION CASTING

CASTING

***

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
82M151	AIR FORCE	78 79		MT FOR CAST TITANIUM COMPRESSOR ROTOR

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	MISSILES	TURBINE ENGINES COMPRESSOR IMPELLER CAST	

CASTING

SUBCOMMITTEE ACCOMPLISHMENTS

- ESTABLISHED JOINT NAVY/AIR FORCE PROGRAM FOR PREMIUM SUPERALLOY CASTINGS

FUTURE SUBCOMMITTEE ACTIVITY

- INVESTIGATE POSSIBILITY OF JOINT NAVY/AIR FORCE PROGRAM FOR MONO-CRYSTAL AIR FOILS
- INTEGRATE ARMY PROGRAM FOR LCF PROPERTY IMPROVEMENT WITH JOINT NAVY/AIR FORCE PROGRAM FOR PREMIUM SUPERALLOY CASTINGS
- INVESTIGATE POSSIBILITY OF JOINT NAVY/AIR FORCE PROGRAM FOR HIP ALUMINUM CASTINGS

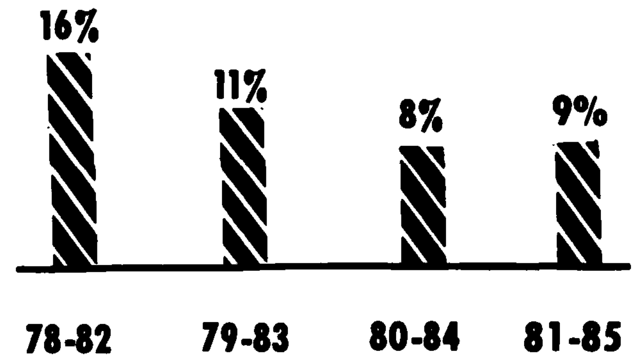
DURING THE PAST YEAR THE SUBCOMMITTEE HAS BEEN RESPONSIBLE FOR ESTABLISHING A JOINT NAVY/AIR FORCE PROGRAM FOR PREMIUM SUPERALLOY CASTINGS.

IN THE NEXT YEAR, THE SUBCOMMITTEE WILL INVESTIGATE THE POSSIBILITY OF A JOINT NAVY/AIR FORCE PROGRAM FOR MONOCRYSTAL AIR FOILS. THE SUBCOMMITTEE WILL INTEGRATE THE ARMY PROGRAM FOR LCF PROPERTY IMPROVEMENT WITH THE JOINT NAVY/AIR FORCE PROGRAM FOR PREMIUM SUPERALLOY CASTINGS TO ENSURE NO DUPLICATION. THE SUBCOMMITTEE WILL ALSO INVESTIGATE THE POSSIBILITY OF A JOINT NAVY/AIR FORCE PROGRAM FOR HIP ALUMINUM CASTINGS.

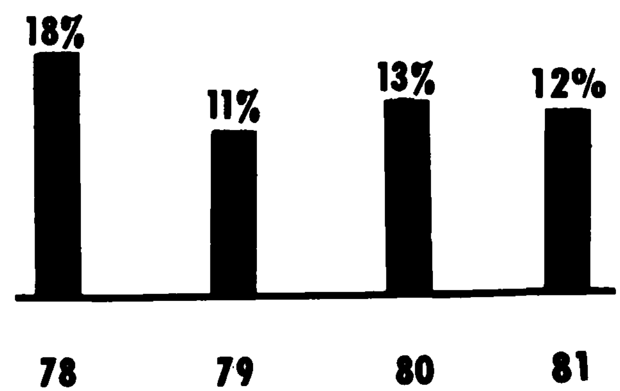
POWDER METALLURGY

FIVE YEAR FUNDING FORECAST ● **19-23 MILLION**

COMPARISON OF FIVE YEAR PLANS



COMPARISON OF INDIVIDUAL YEAR PROGRAMS



IN THE POWDER METALLURGY AREA, THE FIVE YEAR FUNDING FORECAST PROJECTS EXPENDITURES OF 19 TO 23 MILLION DOLLARS. A DOWNWARD TREND THAT APPEARS TO BE LEVELING OFF IS INDICATED BY THE COMPARISON OF THE FIVE YEAR PLANS WHEREAS THE COMPARISON OF INDIVIDUAL YEAR PROGRAMS SHOWS A HIGHER CONSTANT LEVEL OF EFFORT. THE DIFFERENCE BETWEEN THE TWO WOULD INDICATE THAT THE POWDER METALLURGY EFFORT WILL BE DECREASING IN THE FUTURE.

POWDER METALLURGY

TECHNICAL OBJECTIVES

- REFINE PROCESS PARAMETERS
- OBTAIN BETTER MATERIAL UTILIZATION
- OBTAIN HIGH UNIFORM DENSITY AND PROPERTIES
- MEET UNIQUE PERFORMANCE REQUIREMENTS
- REDUCE TOOLING AND PROCESSING COSTS

THE TECHNICAL OBJECTIVES BEING SOUGHT IN THE POWDER METALLURGY AREA ARE TO REFINE THE PROCESSING PARAMETERS, OBTAIN BETTER MATERIAL UTILIZATION, OBTAIN HIGH UNIFORM DENSITY AND PROPERTIES, MEET UNIQUE PERFORMANCE REQUIREMENTS, AND REDUCE TOOLING AND PROCESSING COSTS.

POWDER METALLURGY

FREQUENCY	SPECIFIC PROCESS AREA
1	EXTRUSION PREFORMS
12	HOT ISOSTATIC PRESSING
1	ISOSTATIC PRESSING
1	ISOTHERMAL FORGING
1	OTHER (PM APPROACH)
3	PM FORGING
1	PREP
2	PRESS AND SINTER
2	POWDER MANUFACTURE
1	PRESSING, VACUUM HOT

THIS CHART SHOWS THE PROCESSES BEING WORKED ON IN THE POWDER METALLURGY AREA AND THE NUMBER OF PROJECTS PURSUING EACH SPECIFIC PROCESS.

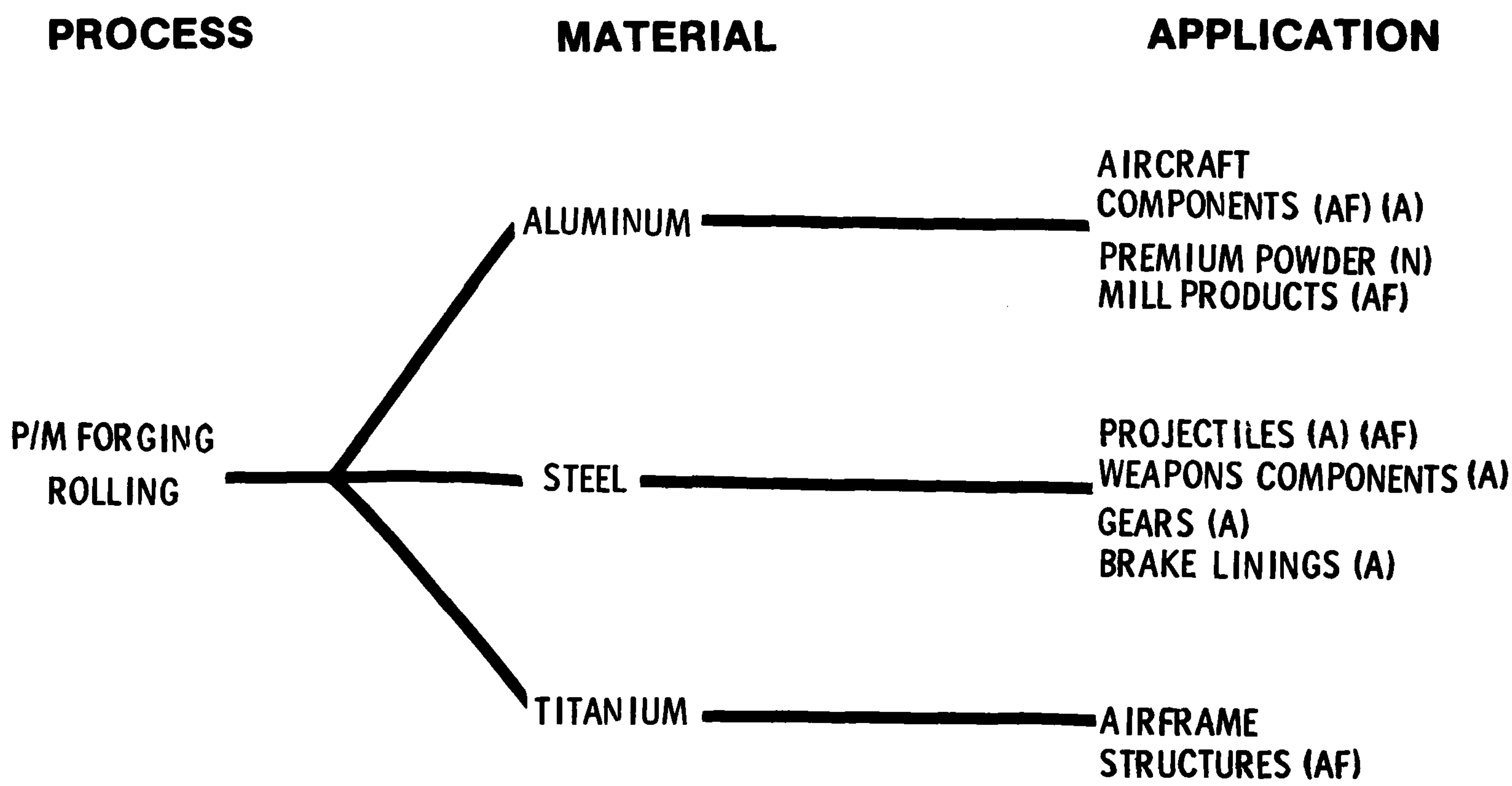
POWDER METALLURGY

FY 81 PROGRAM REVIEW

- **12 PROJECTS REVIEWED**
- **COMMON AREAS IDENTIFIED**
    - P/M FORGING/ROLLING
    - HOT ISOSTOTIC PRESSING

THE SUBCOMMITTEE REVIEWED 12 FY81 PROJECTS. WE IDENTIFIED P/M FORGING/ROLLING AND HOT ISOSTATIC PRESSING AS COMMON AREAS.

POWDER METALLURGY

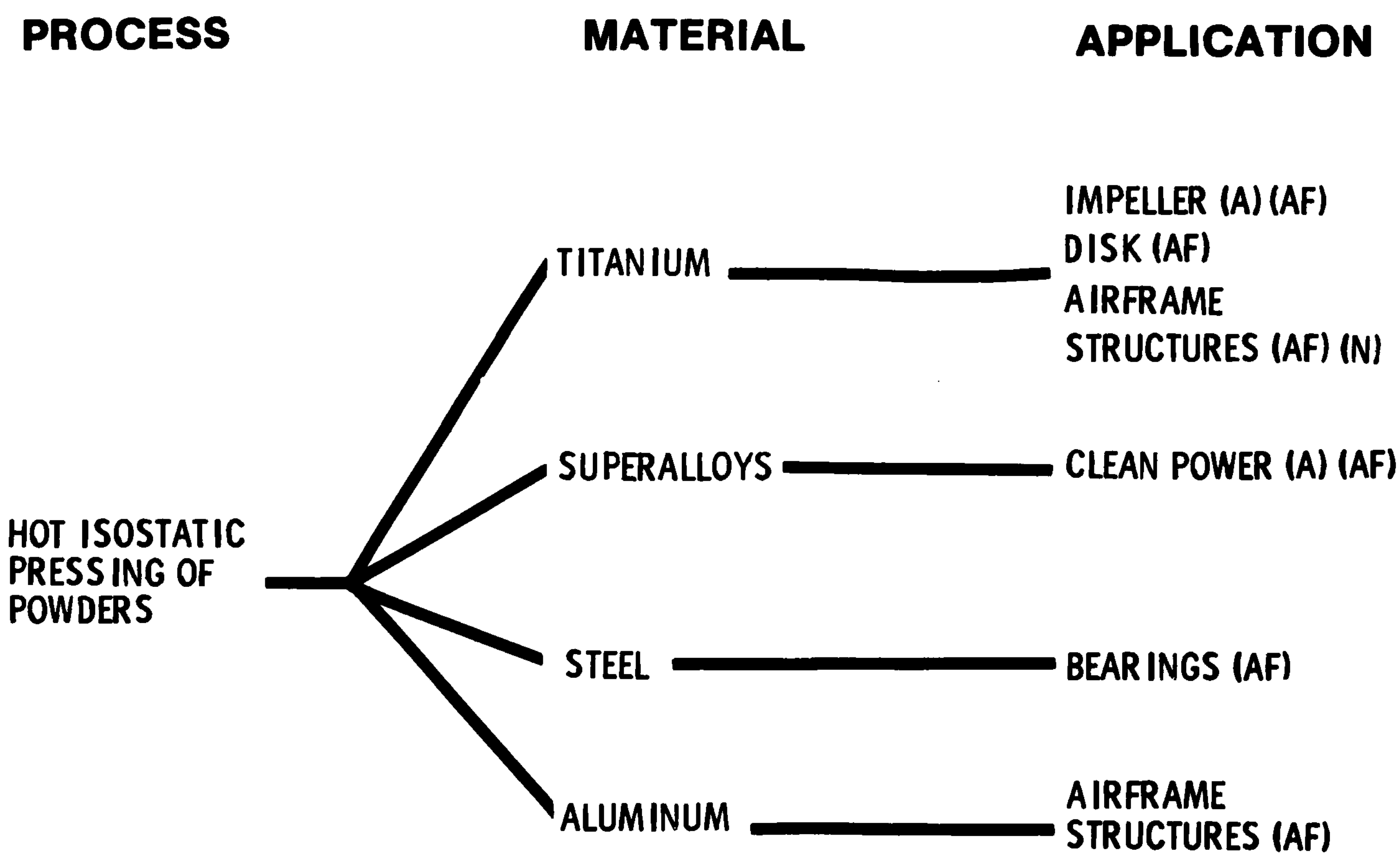


THE ARMY AND AIR FORCE ARE JOINTLY FUNDING AN EFFORT TO VACUUM HOT PRESS ALUMINUM AIRCRAFT STRUCTURAL COMPONENTS. THE NAVY IS PROPOSING TO SCALE-UP THE PRODUCTION OF PREMIUM ALUMINUM POWDER AND THE AIR FORCE IS PROPOSING TO SCALE-UP ARMY ESTABLISHED PROCESSES FOR MAKING ALUMINUM MILL PRODUCTS.

THE ARMY'S STEEL PROJECTILE WORK ESTABLISHED A PROCESS FOR MAKING 100 PERCENT DENSE MORTAR ROUNDS WHEREAS THE AIR FORCE IS ESTABLISHING PROCESSES TO MAKE PARTIALLY DENSE TARGET PRACTICE ROUNDS WHICH WILL DISINTEGRATE UPON IMPACT. THE REST OF THE STEEL P/M WORK IS FUNDED BY THE ARMY.

THE AIR FORCE HAS ESTABLISHED VACUUM HOT PRESSING OF TITANIUM AIRFRAME STRUCTURES.

POWDER METALLURGY



THE ARMY AND AIR FORCE ARE JOINTLY ESTABLISHING THE HOT ISOSTATIC PRESSING PROCESS FOR MAKING TITANIUM TURBINE ENGINE IMPELLERS. THE NAVY AND AIR FORCE ARE JOINTLY FUNDING AN EFFORT TO APPLY HOT ISOSTATIC PRESSING TO TITANIUM AIR FRAME STRUCTURES.

THE ARMY AND AIR FORCE ARE ESTABLISHING PROCESSING PARAMETERS FOR MAKING CLEAN SUPERALLOY POWDERS.

POWER METALLURGY

FY80 PROGRAM CHANGES REVIEW

- 7 NEW PROGRAM CHANGES REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED SEVEN NEW FY80 PROJECTS AND FOUND NO NEW COMMON AREAS THAT HAD NOT BEEN IDENTIFIED IN THE REVIEW OF FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT CONTAINS ALL ACTIVE, APPORTIONMENT AND BUDGET PROJECTS WHICH HAVE BEEN CLASSIFIED AS POWDER METALLURGY. THEY HAVE BEEN SORTED BY THE MATERIAL BEING PROCESSED AND THE APPLICATION TO WHICH IT IS BEING APPLIED.

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA81078	NAVY	81		PREMIUM ALUMINUM POWDER

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	MISC HARDWARE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M167	AIR FORCE	81 80	NU	MT FOR PM ALUMINUM PLATE PRODUCTION SCALE-UP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	STRUCTURES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M121	AIR FORCE	81 82		PM ALUMINUM LONGERON COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	LONGERON	FORGING EXTRUSION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7238	ARMY	79 77		PRECISION FORGED ALUMINUM PM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAME MISC COMPONENTS	PM FORGING

POWDER METALLURGY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M169	AIR FORCE	80 77	NU	ALUMINUM PM FOR PRECISION PARTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	HOT ISOSTATIC PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91M116	AIR FORCE	80 79 81		HIGH STRENGTH PM ALUMINUM MILL PRODUCTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	STRUCTURES	PM FORGING EXTRUSION PREFORMS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M172	AIR FORCE	80	NU	MT FOR INJECTION MOLDED COLUMBIUM COMBUSTORS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
COLUMBIUM	MISSILES	TURBINE ENGINES COMBUSTOR	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5007	ARMY	79 80		ADVANCED TECHNOLOGY BRAKE LINING MATERIALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
IRON	LAND VEHICLES	BRAKE LININGS	PRESS AND SINTER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 6683	ARMY	78 77		PRODUCTION OF TUNGSTEN BASE ALLOY PENETRATORS FOR AP MUNITION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AMMUNITION	METAL PARTS PROJECTILE PENETRATORS	HOT ISOSTATIC PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DN300587	NAVY	79		POWDERED METAL SINTERING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	MISSILES	ROCKET MOTORS JET VANE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M103	AIR FORCE	81 82		MT FOR SCALE UP OF PM BEARING MATERIALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TURBINE ENGINES	HOT ISOSTATIC PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
08M129	AIR FORCE	80 81		MT FOR 20MM FRANGIBLE PROJECTILE FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	PROJECTILE FRANGIBLE	OTHER (PM APPROACH)

POWDER METALLURGY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 6211	ARMY	75		SINTERED STEEL PREFORMS FOR WORKING INTO FRAG SHELL BODIES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	METAL PARTS PROJECTILES	EXTRUSION, COLD PRESS AND SINTER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
78M155	AIR FORCE	77 78 79		MT FOR FRANGIBLE PROJECTILES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	TARGET PROJECTILES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5083	ARMY	79 78 77		UPSCALING OF ADVANCED POWDER METALLURGY PROCESSES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	GEARS	ISOTHERMAL FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7926	ARMY	80 82		HOT ISOSTATIC PRESSING OF LARGE ORDNANCE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BREECH BLOCKS	HOT ISOSTATIC PRESSING

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***
                                  YEARS OF
    EFFORT NO    SERVICE          FUNDING       STATUS    TITLE
***
*   6 8102       ARMY                81                   APPLICATION OF POWDER METALLURGY FORGING WEAPONS COMPONENTS
*                                    83

                 MATERIAL              APPLICATION            COMPONENT                     SPECIFIC PROCESS
***
*                STEEL                 WEAPONS                BRACKETS                      PM FORGING
*                                                             EXTRACTORS
*                                                             FIRING PINS
------------------------------------------------------------------------------

                                  YEARS OF
    EFFORT NO    SERVICE          FUNDING       STATUS    TITLE
***
*   6 7649       ARMY                76                   COMPUTERIZED POWDER METALLURGY FORGING DESIGN-CAM
*                                    77

                 MATERIAL              APPLICATION            COMPONENT                     SPECIFIC PROCESS
***
*                STEEL                 WEAPONS                SMALL ARMS COMPONENTS         PM FORGING
------------------------------------------------------------------------------

                                  YEARS OF
    EFFORT NO    SERVICE          FUNDING       STATUS    TITLE
***
*   6 8163       ARMY                81                   P/M STEEL PREFORMS FOR SMALL CALIBER WEAPONS
*                                    82

                 MATERIAL              APPLICATION            COMPONENT                     SPECIFIC PROCESS
***
*                STEEL                 WEAPONS                BOLTS                         ISOSTATIC PRESSING
*                                                                                           SINTERING
------------------------------------------------------------------------------

                                  YEARS OF
    EFFORT NO    SERVICE          FUNDING       STATUS    TITLE
***
*   T1M186       AIR FORCE           76                   MT FOR NEAR NET DISK SHAPE PRODUCTION
*                                    77
*                                    78

                 MATERIAL              APPLICATION            COMPONENT                     SPECIFIC PROCESS
***
*                SUPERALLOY            AIRCRAFT               TURBINE ENGINES               HIP
*                                                             DISKS
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POWDER METALLURGY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M103	AIR FORCE	80 81		MT FOR DR POWDER BLADES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES	GRADIENT HEATING
		BLADE TURBINE	
	MISSILES	TURBINE ENGINES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M130	AIR FORCE	80 81 82 83		MT FOR EFFECTS OF MANUFACTURING PROCESSES ON STRUCTURAL ALLOWABLES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	AIRFRAMES	HOT ISOSTATIC PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M183	AIR FORCE	80 81 82	NU	MT FOR ADVANCED SUPERALLOY PM FOR ROTATING COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES ROTATING COMPONENTS	HOT ISOSTATIC PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M107	AIR FORCE	81		MT FOR RQP DISKS WITH LCF LIFE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	DISKS	HOT ISOSTATIC PRESSING

POWDER METALLURGY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7286	ARMY	78 79 80		HIGH QUALITY SUPERALLOY POWDER PRODUCTION FOR TURBINE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES TURBINE COMPONENTS	STEPS FOR MAKING POWDER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M874	AIR FORCE	77 78 79		MT FOR PRODUCTION OF AN ADVANCED SUPERALLOY DUAL-PROPERTY TURBINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES	HIP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M158	AIR FORCE	80		MT FOR IMPROVED SUPERALLOY POWDER PRODUCTION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES DISK COMPRESSOR DISK TURBINE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91M124	AIR FORCE	80 79	NU	MT FOR IMPROVED SUPERALLOY POWDER PRODUCTION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	DISKS TURBINE ENGINES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T1M184	AIR FORCE	80 77 78	NU	MT FOR PRODUCTION OF LARGE NEAR-NET TITANIUM PM PARTS BY HIP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRFRAME STRUCTURES TURBINE ENGINES	HOT ISOSTATIC PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T1M189	AIR FORCE	76 77 80	NU	MT FOR ADVANCED TL POWDER PRODUCTION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES AIRFRAME STRUCTURES	POWDER MAKING PREP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T1M190	AIR FORCE	76 77		MT FOR VACUUM HOT PRESSING OF LARGE TITANIUM SHAPES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRFRAME STRUCTURES	PRESSING, VACUUM HOT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T1M191	AIR FORCE	77 78 79		MT FOR ALTERNATE LARGE TITANIUM PM PARTS BY HIP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	ENGINE COMPONENTS AIRFRAME COMPONENTS	HIP

POWDER METALLURGY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7291	ARMY	79 80		TITANIUM POWDER METAL COMPRESSOR IMPELLER

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES COMPRESSOR IMPELLER	HOT ISOSTATIC PRESSING

POWDER METALLURGY

FUTURE SUBCOMMITTEE ACTIONS

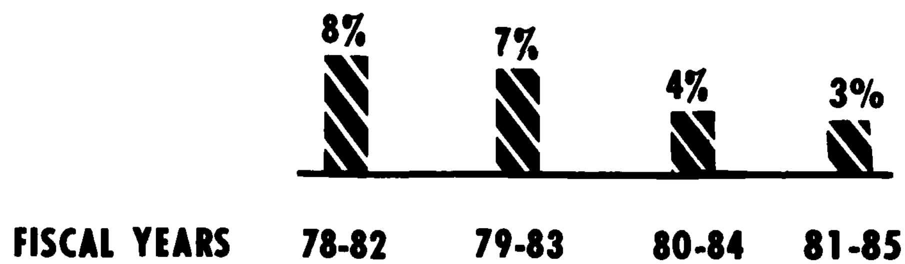
- INVESTIGATE POSSIBILITY OF A JOINT NAVY/AIR FORCE PROGRAM FOR PM ALUMINUM MILL PRODUCTS
- INVESTIGATE POSSIBILITY OF A JOINT ARMY/AIR FORCE PROGRAM FOR PM BEARINGS

DURING THE REVIEWS THE NAVY EXPRESSED INTEREST IN POSSIBLY JOINING THE AIR FORCE'S PROGRAM FOR ALUMINUM MILL PRODUCTS AND THE ARMY EXPRESSED INTEREST IN POSSIBLY JOINING THE AIR FORCE'S PROGRAM FOR P/M BEARINGS.

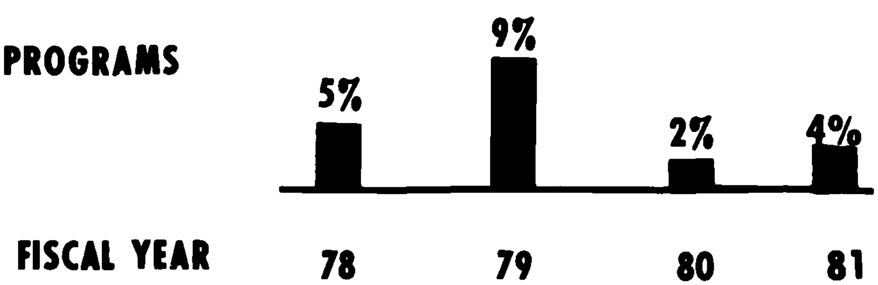
EXTRUSION AND ROLLING

FIVE YEAR FUNDING FORECAST ● 7-10 MILLION

COMPARISON OF FIVE YEAR PLANS



COMPARISON OF INDIVIDUAL YEAR PROGRAMS



IN THE EXTRUSION AND ROLLING AREA, THE FIVE YEAR FUNDING FORECAST PROJECTS EXPENDITURES OF BETWEEN 7 TO 10 MILLION DOLLARS. THE COMPARISON OF THE FIVE-YEAR PLANS SHOWS A RELATIVELY LOW LEVEL OF EFFORT AS DOES THE COMPARISON OF INDIVIDUAL YEAR PROGRAMS.

EXTRUSION AND ROLLING

TECHNICAL OBJECTIVES

- IMPROVE MATERIAL UTILIZATION
- INCREASE ADVANCED MATERIAL CAPABILITY
- IMPROVE MATERIAL WORKABILITY
- INCREASE DEGREE OF AUTOMATION
- CONSERVE ENERGY

THE TECHNICAL OBJECTIVES BEING SOUGHT IN THE EXTRUSION AND ROLLING AREA ARE TO IMPROVE MATERIAL UTILIZATION, INCREASE ADVANCED MATERIAL CAPABILITY, IMPROVE MATERIAL WORKABILITY, INCREASE THE DEGREE OF AUTOMATION AND CONSERVE ENERGY.

EXTRUSION & ROLLING

FREQUENCY	SPECIFIC PROCESS
1	AUSTROLLING
1	COLD ROLLING
1	EDGE ROLLING
1	ROLLING THREADS
2	ROLLING, ISOTHERMAL

THIS CHART SHOWS THE SPECIFIC PROCESSES BEING ESTABLISHED AND THE NUMBER OF PROJECTS USING EACH SPECIFIC PROCESS.

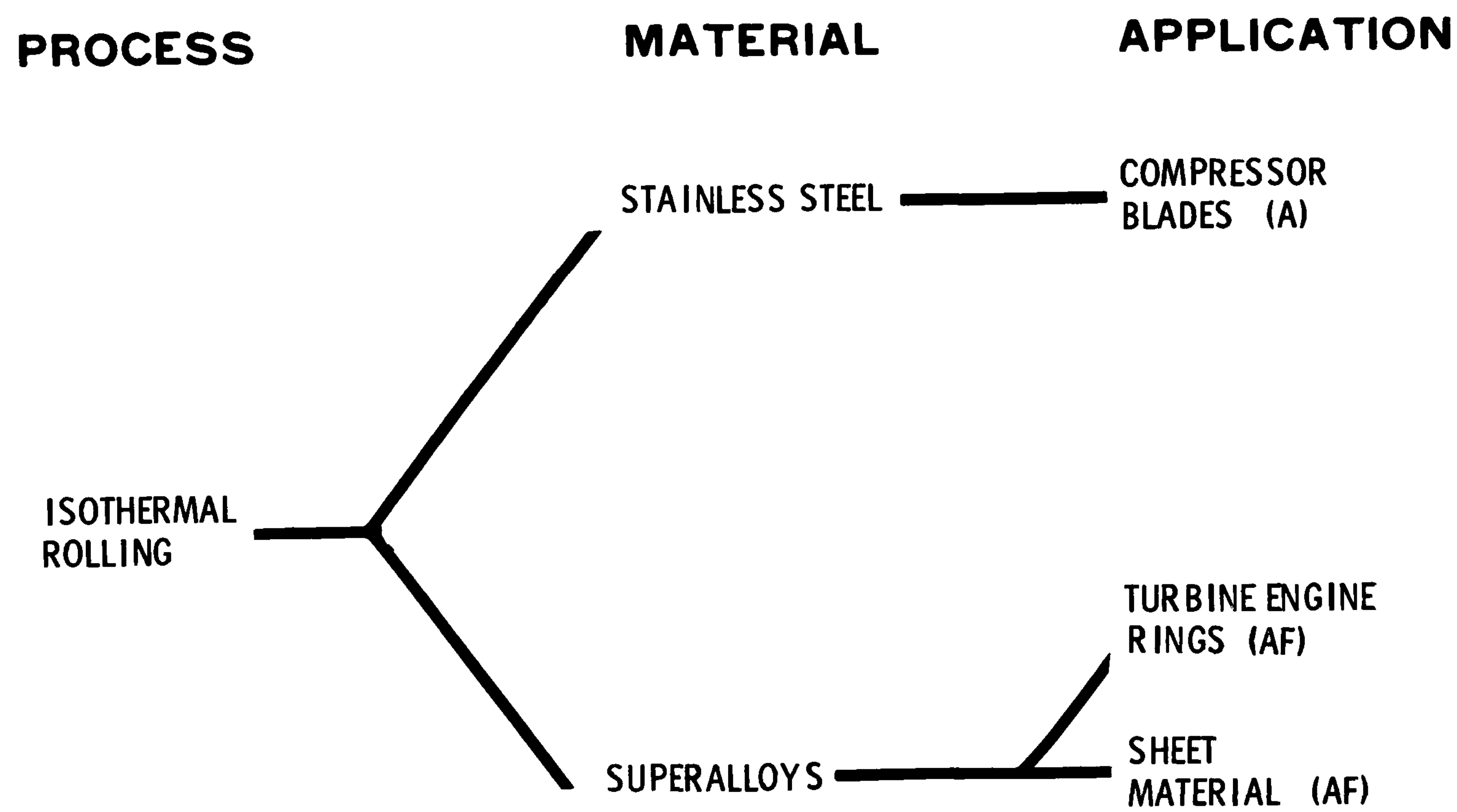
EXTRUSION AND ROLLING

FY81 PROGRAM REVIEW

- 4 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - ISOTHERMAL ROLLING

THE SUBCOMMITTEE REVIEWED 4 FY81 PROJECTS DEALING WITH EXTRUSION AND ROLLING. ISOTHERMAL ROLLING WAS IDENTIFIED AS THE ONLY COMMON AREA OF INTEREST AMONG THE SERVICES.

EXTRUSION AND ROLLING



THE ARMY IS ESTABLISHING ISOTHERMAL ROLLING PROCESS FOR MAKING COMPRESSOR BLADES AND THE AIR FORCE IS USING IT TO PRODUCE SUPERALLOY RINGS AND SHEET MATERIAL.

EXTRUSION AND ROLLING

FY80 PROGRAM CHANGES REVIEW

- 2 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

TWO NEW FY80 PROJECTS WERE REVIEWED AND NO NEW COMMON AREAS WERE IDENTIFIED THAT HAD NOT BEEN ALREADY IDENTIFIED DURING THE REVIEW OF FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT LISTS ALL THE ACTIVE, BUDGET AND APPORTIONMENT EXTRUSION AND ROLLING PROJECTS. THE PROJECTS HAVE BEEN SORTED BY THE MATERIAL BEING PROCESSED AND THE APPLICATION.

EXTRUSION

	EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
*	18M134	AIR FORCE	81		MT FOR TUBULAR PROJECTILES

	MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
*	OTHER	AMMUNITION		EXTRUSION, IMPACT

ROLLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7036	ARMY	79 78 75 81		ISOTHERMAL ROLL FORGING OF COMPRESSOR BLADES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TURBINE ENGINES COMPRESSOR BLADES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7155	ARMY	78 80 81		COST EFFECTIVE MFG METHODS FOR HELICOPTER GEARS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TRANSMISSION GEARS	AUSTROLLING COLD ROLLING ULTRASONIC INSPECTION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4309-08	ARMY	80	NU	PROCESSES FOR ECONOMICAL FABRICATION OF BODY FOR APDS AMMUNITION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	BODY, APDS PROJECTILES	ROLLING THREADS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5081	ARMY	79 80		FABRICATION OF FRICTION RINGS AND REACTION PLATES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	FRICTION RINGS REACTION PLATES	EDGE ROLLING WELDING

ROLLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91M128	AIR FORCE	80 79 81		MT FOR ROLLING HIGH TEMPERATURE SHEET

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES COMBUSTORS	ROLLING ISOTHERMAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M868	AIR FORCE	80 77	NU	MT FOR SUPERALLOY ENGINE RING ROLLING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES RINGS	

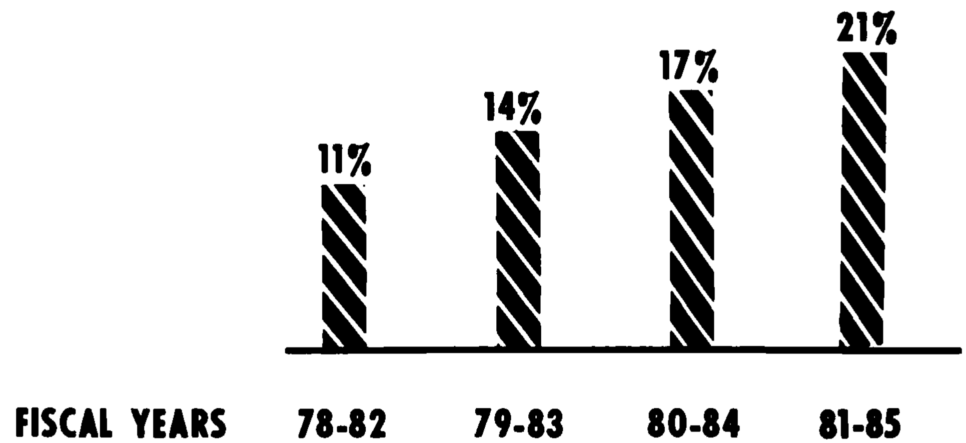
EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
51M894	AIR FORCE	76 77		MT FOR ISOTHERMAL ROLLED TITANIUM ENGINE RINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES RINGS	ROLLING, ISOTHERMAL

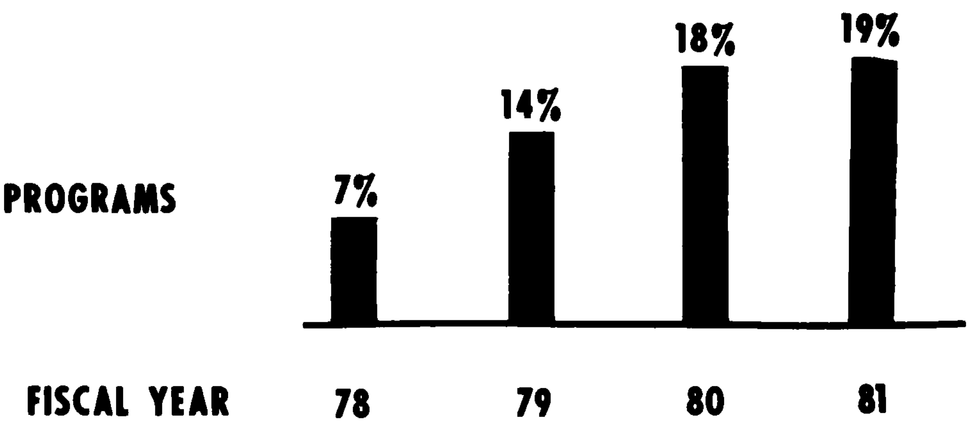
METAL REMOVAL

FIVE YEAR FUNDING FORECAST ● 48-52 MILLION

COMPARISON OF FIVE YEAR PLANS



COMPARISON OF INDIVIDUAL YEAR PROGRAMS



IN THE METAL REMOVAL AREA, THE FIVE YEAR FUNDING FORECAST PROJECTS EXPENDITURES OF BETWEEN 48 TO 52 MILLION DOLLARS. THE COMPARISON OF FIVE YEAR PLANS SHOWS A STRONG UPWARD TREND WHICH IS SUPPORTED BY THE COMPARISON OF THE INDIVIDUAL YEAR PROGRAMS. IT APPEARS THAT THE METAL REMOVAL EFFORT SHOULD BEGIN TO LEVEL OFF IN THE NEAR FUTURE.

METAL REMOVAL

TECHNICAL OBJECTIVES

- IMPROVE MACHINABILITY DATA BASE
- INCREASE RATE OF REMOVAL
- IMPROVE PROCESS EFFICIENCY
- IMPROVE SURFACE INTEGRITY

THE TECHNICAL OBJECTIVES BEING SOUGHT IN METAL REMOVAL AREA ARE TO IMPROVE THE MACHINABILITY DATA BASE, INCREASE THE RATE OF METAL REMOVAL, IMPROVE PROCESS EFFICIENCY AND IMPROVE (OR AT LEAST NOT DEGRADE) SURFACE INTEGRITY.

METAL REMOVAL

FREQUENCY	SPECIFIC PROCESS
1	ABRASIVE BERT MACHING
1	ABRASIVE PARTICLE FLOW
1	ADAPTIVE CONTROL
1	AUTOMATED HOLE CUTTING
1	BENCHING
4	BORING
3	BROACHING
1	CENTRAL COLLANT SYSTEM
1	CRUSH FORM GRINDING
1	CUTTING FLUID PERORMAN*
3	DATA GENERATION
4	DRILLING
1	DUAL RIFLING
4	ECM
1	ECONOMIC MODELING
2	EDM
2	ELECTROPOLISHING
1	ENGRAVING, PORTABLE
2	FIXTURING
1	FLEXIBLE MACHINING
2	GRINDING
3	IN PROCESS INSPECTION AND CONTROL
1	LAYOUT
1	MACHINE TOOL TESTING
2	MACHINING, HIGH SPEED
2	MACHINING, LASER ASSIST*
1	MACHINING, PLASMA ASSIST
3	MACHINING, PRECISION
3	MILLING
1	MILLING, HIGH SPEED
1	MILL, 4 SPINDLE, 5 AXIS
1	PLASMA ARC CUTTING
1	PRECISION PINION MFR
1	ROTATING CUTTER CUT OFF
1	ROUGH THREAD BLANKING
1	SLITTING
1	STANDARDS FOR SURF FIN
2	TOOL DESIGN
1	TOOLS, COATING
6	TURNING
1	TURN, MILL, DRILL

THE SPECIFIC PROCESSES AND THE NUMBER OF PROJECTS INVOLVED WITH EACH PROCESS IS SHOWN ON THIS CHART.

METAL REMOVAL

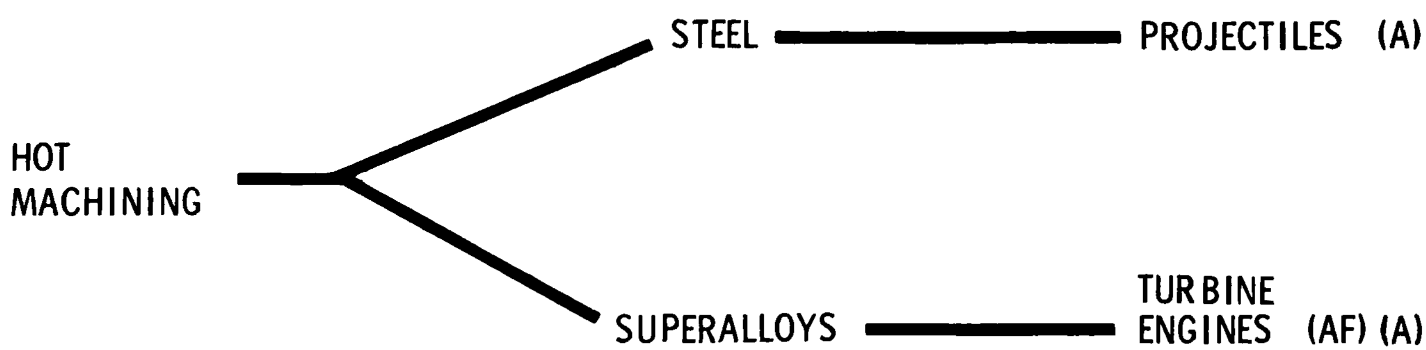
FY 81 PROGRAM REVIEW

- 27 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - HOT MACHINING
  - IN PROCESS INSPECTION AND CONTROL
  - HIGH SPEED MACHINING
  - ECM/EDM
  - PRESCISION MACHINING

THE SUBCOMMITTEE REVIEWED 27 FY81 PROJECTS; HOT MACHINING, IN PROCESS INSPECTION AND CONTROL, HIGH SPEED MACHINING, PRECISION MACHINING, AND ECM/EDM WERE IDENTIFIED AS COMMON AREAS.

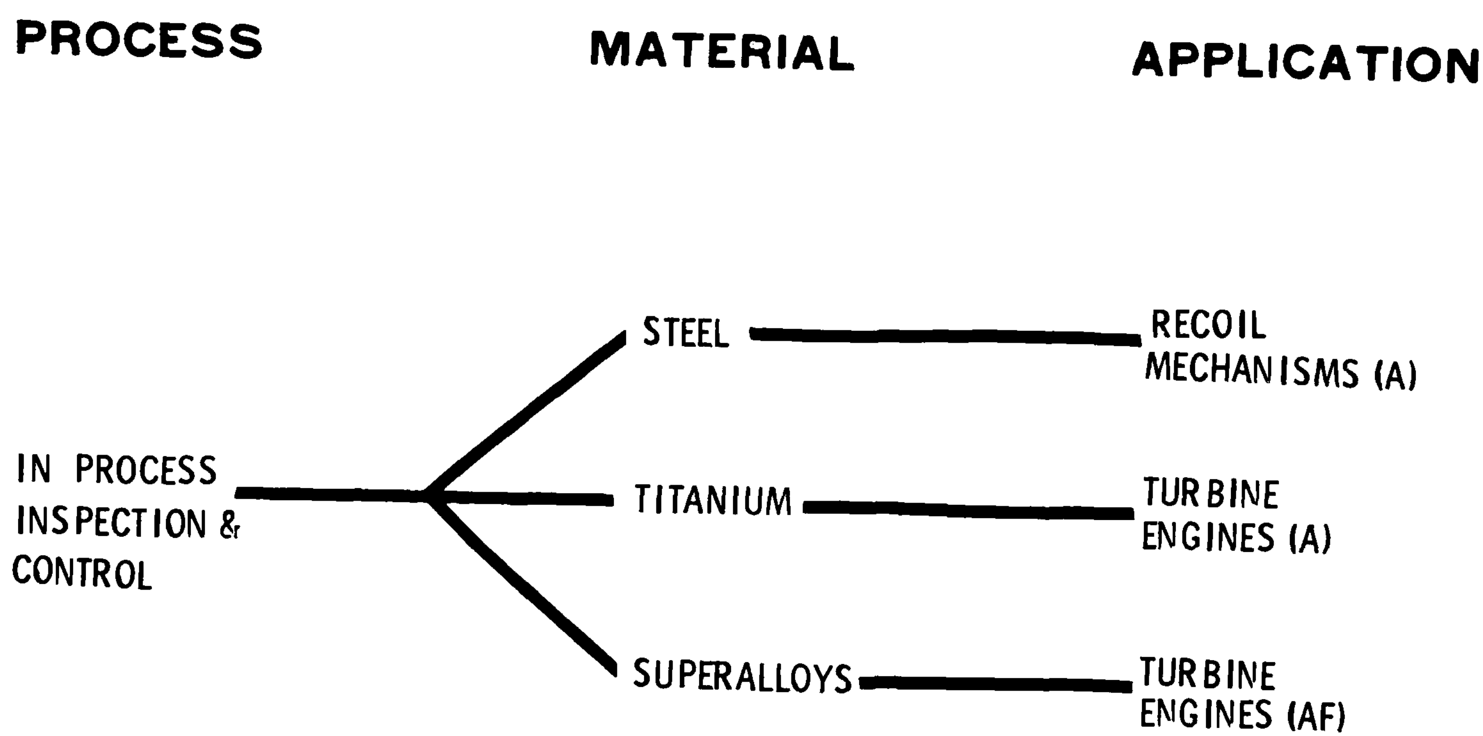
METAL REMOVAL

PROCESS | **MATERIAL** | **APPLICATION**



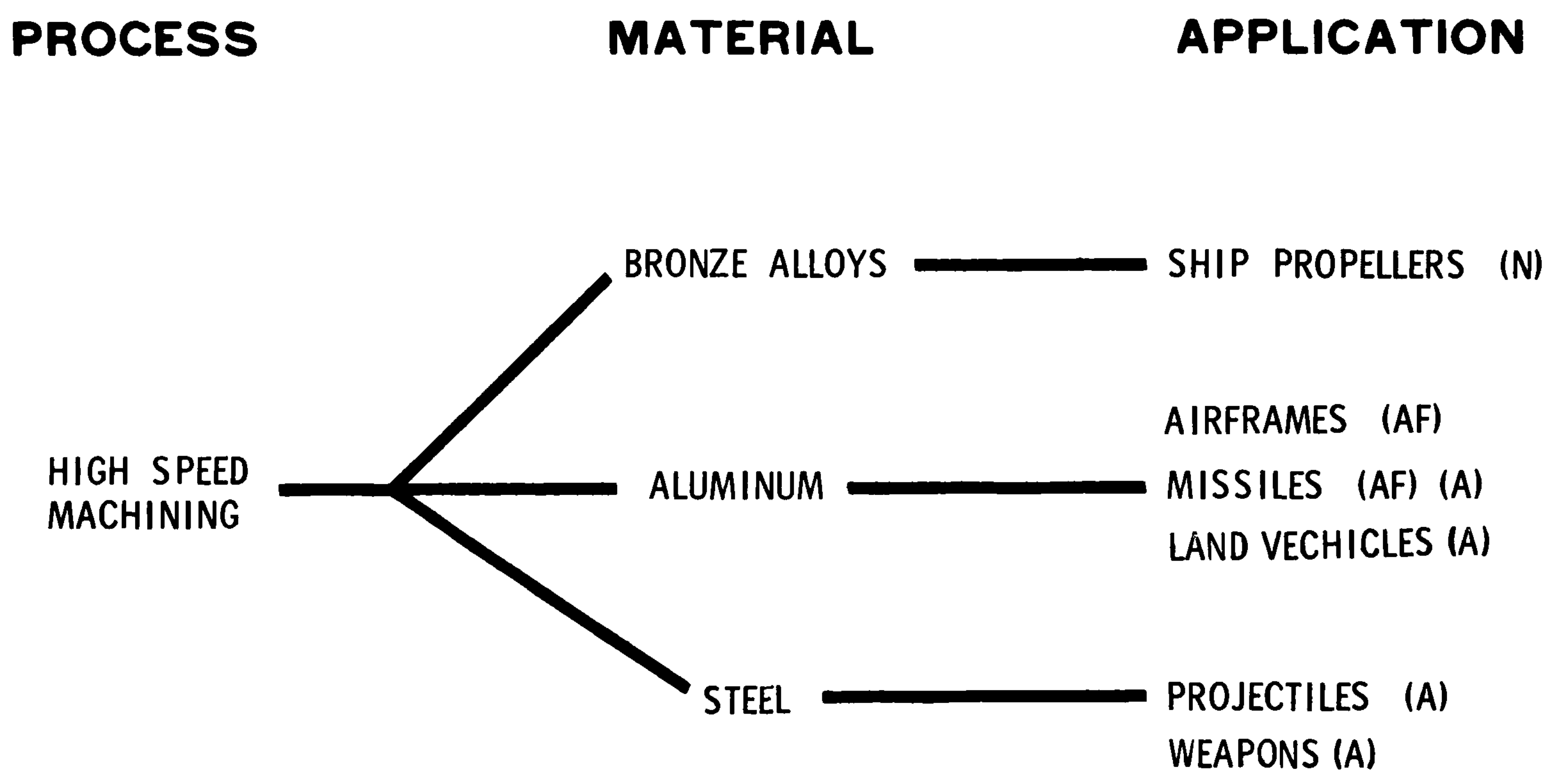
BOTH THE ARMY AND AIR FORCE ARE PROPOSING TO USE LASER ASSISTED MACHINING FOR SUPERALLY TURBINE ENGINE COMPONENTS. THESE SERVICES WILL MEET TO DISCUSS HOW DUPLICATION WILL BE AVOIDED.

METAL REMOVAL



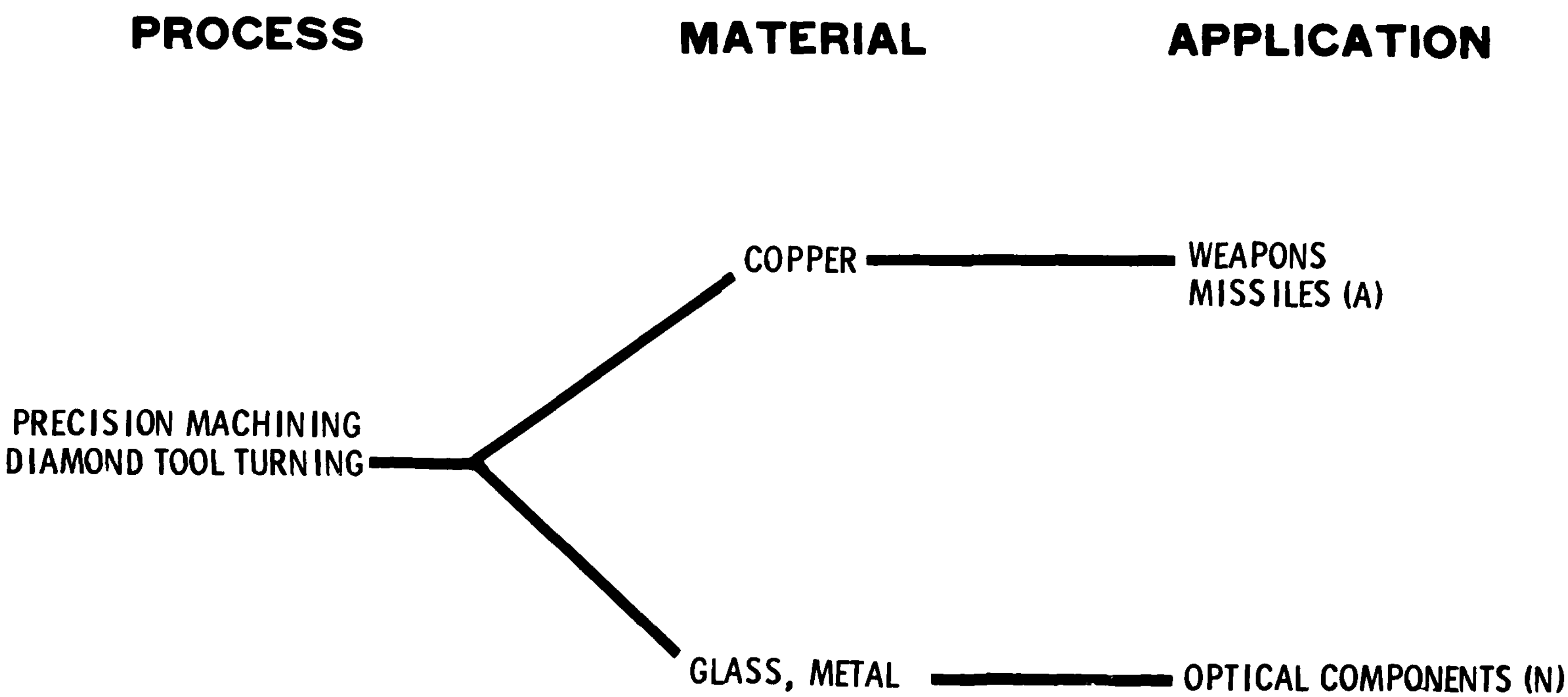
THE ARMY AND AIR FORCE WILL MEET TO DISCUSS HOW DUPLICATION CAN BE AVOIDED IN THE APPLICATION OF IN PROCESS INSPECTION AND CONTROL.

METAL REMOVAL



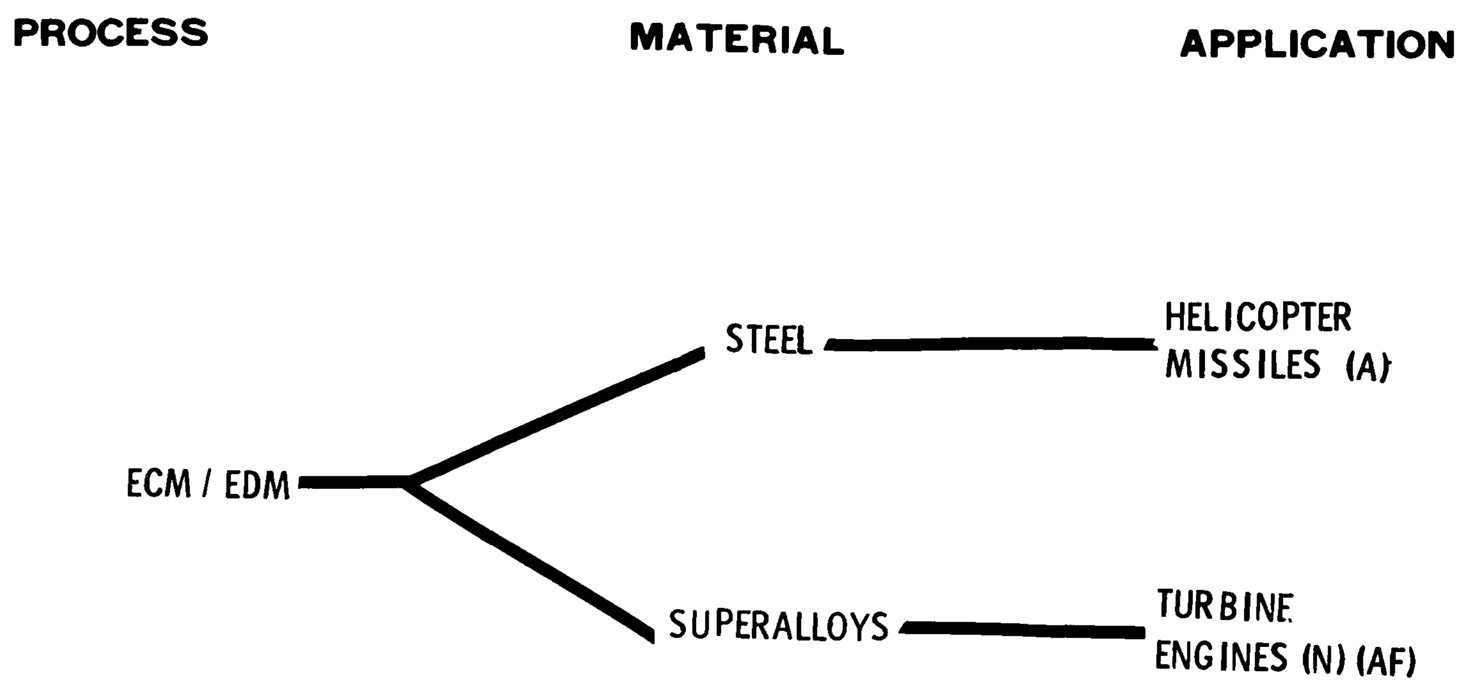
THE ARMY AND AIR FORCE WILL MEET TO DISCUSS HOW THE HIGH SPEED MACHINING OF ALUMINUM EFFORTS, THE DARPA FUNDED RESEARCH EFFORT AND THE STEEL HIGH SPEED MACHINING EFFORTS CAN BE INTEGRATED INTO A COHESIVE PROGRAM WHICH ELIMINATES DUPLICATION OF EFFORT.

METAL REMOVAL



THE ARMY AND NAVY PROGRAMS HAVE COORDINATED AND PLANNED SO THAT DUPLICATION WILL NOT OCCUR.

METAL REMOVAL



THE NAVY AND AIR FORCE ARE APPLYING ECM TO TWO DIFFERENT TYPE MACHINING PROBLEMS. THE SUBCOMMITTEE DETERMINED THAT NO DUPLICATION EXISTED.

METAL REMOVAL

FY 80 PROGRAM CHANGES REVIEW

- 1 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED 1 NEW FY80 PROJECT. NO NEW COMMON AREAS WERE IDENTIFIED THAT HAD NOT BEEN IDENTIFIED DURING THE REVIEW OF THE FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT LISTS THE ACTIVE, APPORTIONMENT, AND BUDGET PROJECTS WHICH HAVE BEEN CLASSIFIED AS METAL REMOVAL. THE PROJECTS HAVE BEEN SORTED BY THE MATERIAL BEING MACHINED AND ITS APPLICATION.

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-**
                                YEARS OF
   EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*  01M250       AIR FORCE          82          NU     MT FOR ADVANCED METAL REMOVAL INITIATIVE
*                                  81
*                                  80

                  MATERIAL            APPLICATION          COMPONENT                   SPECIFIC PROCESS
***
*                 ALUMINUM            AIRCRAFT             TURBINE ENGINES             ECONOMIC MODELING
*                                                                                      TOOLS, INNOVATIVE
*                                                                                      MACHINING, LASER ASSISTE
                                                                                       D
*                                                          STRUCTURES
*                                     MISSILES             STRUCTURES
------------------------------------------------------------------------------

                                YEARS OF
   EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*  T 5093       ARMY               81                 HIGH-SPEED MACHINING OF TCV COMPONENTS (PHASE I)
*                                  82
*                                  83
*                                  84

                  MATERIAL            APPLICATION          COMPONENT                   SPECIFIC PROCESS
***
*                 ALUMINUM            LAND VEHICLES        XM2 VEHICLE                 MACHINING, HIGH SPEED
------------------------------------------------------------------------------

                                YEARS OF
   EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*  02M271       AIR FORCE          81          NU     MT FOR HIGH SPEED MACHINING
*                                  80

                  MATERIAL            APPLICATION          COMPONENT                   SPECIFIC PROCESS
***
*                 ALUMINUM            MISSILES             STRUCTURES
------------------------------------------------------------------------------

                                YEARS OF
   EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*  DNS00510     NAVY               78                 HIGH SPEED MACHINING OF SHIP PROPELLERS

                  MATERIAL            APPLICATION          COMPONENT                   SPECIFIC PROLESS
***
*                 BRONZE              SHIPS                PROPELLER                   MILLING, HIGH SPEED
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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8165	ARMY	81 82		STANDARDS FOR DIAMOND TURNED OPTICAL PARTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
COPPER	WEAPONS	OPTICAL MIRRORS	MACHINING, PRECISION STANDARDS FOR SURF FIN

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
0N300693	NAVY	80	NU	LOW COST MACHINED OPTICS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
COPPER ALLOY	MISSILES	LENSES DOMES MIRRORS	MACHINING, PRECISION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
R 3445	ARMY	80 79 81		PRECISION MACHINING OF OPTICAL COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
COPPER ALLOY	MISSILES	MIRRORS	MACHINING, PRECISION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M261	AIR FORCE	80	NU	MT FOR MACHINE TOOL TASK FORCE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AIRCRAFT	STRUCTURES MISSILES STRUCTURES	

METAL REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M760	AIR FORCE	78		MT FOR VERIFICATION OF PRODUCTION HOLE QUALITY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AIRCRAFT	AIRFRAME HOLE QUALITY	DRILLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00277	NAVY	79		CUTTING TOOL COATING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT		TOOLS, COATING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7104	ARMY	78 77		TURBINE NOZZLE MANUFACTURING TECHNOLOGY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TURBINE ENGINES MISC COMPONENTS	GRINDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7240	ARMY	78 79 80		MACHINING METHODS FOR ESR 4340 STEEL HELICOPTER APPLICATIONS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	INTEGRAL ARMOR COMPONENT	ECM EDM

METAL REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
S 4402	ARMY	81 82		IMPROVED HSS PRECISION GEAR HOBS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	FUZE	PRECISION PINION MFR

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
S 6738	ARMY	79 80		ULTRA HIGH SPEED METAL REMOVAL, ARTILLERY SHELL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	PROJECTILE, ARTILLERY PROJECTILE, MORTAR	TURNING MACHINING, PLASMA ASSIST

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5082	ARMY	79 80 81		FLEXIBLE MACHINING SYSTEMS PILOT LINE FOR TCV COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	MID VOLUME COMPONENTS	FLEXIBLE MACHINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5096	ARMY	79 80 81		IMPROVED AND COST EFFECTIVE MACHINING TECHNOLOGY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	HOUSINGS COVERS	TURN, MILL, DRILL DATA GENERATION

METAL REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
R 1018	ARMY	80		IMPROVED MANUFACTURING PROCESSES FOR DRY TUNED ACCELEROMETERS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	MISSILES	ACCELEROMETER, DRY TUNED	ECM EDM

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00638	NAVY	80		AUTOMATIC PLASMA ARC CUTTING MACHINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	PIPE BOX TUBING I BEAMS	PLASMA ARC CUTTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00635	NAVY	80		HULL ACCESS HOLES AUTOMATIC CUTTING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULLS	AUTOMATED HOLE CUTTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8342	ARMY	80		KEYWAY MILLING MACHINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARREL, CANNON	MILLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7730	ARMY	79 80		MANUFACTURE OF SPLIT RING BREECH SEALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BREECH RING SEALS	SLITTING CRIMPING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8107	ARMY	79 80 81		CREEP FEED CRUSH FORM GRINDING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BRACKET FOR BREECH BLOCK RACK TEETH FOR COUPLING	CRUSH FORM GRINDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8024	ARMY	80 82		HIGH SPEED ABRASIVE BELT GRINDING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARREL, CANNON	ABRASIVE BELT MACHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8105	ARMY	80 81		ESTABLISH ROUGH THREAD BLANKS, 8-INCH M201 BUSHING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARREL, CANNON	ROUGH THREAD BLANKING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8120	ARMY	81		ADAPTIVE CONTROL TECHNOLOGY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON COMPONENTS	ADAPTIVE CONTROL DRILLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8106	ARMY	80 81 82		LARGE CALIBER POWDER CHAMBER BORING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARRELS, CANNON	BORING, BALANCED TOOL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7927	ARMY	80 81		GENERATION OF BASE MACHINING SURFACE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BREECH COMPONENTS	LAYOUT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7925	ARMY	80 81		BORE EVACUATOR BORING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES BORE EVACUATOR	BORING

METAI REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7933	ARMY	78		CENTRAL COLLANT SYSTEMS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	CENTRAL COLLANT SYSTEM CUTTING FLUIDS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7948	ARMY	80 79 81		ESTABLISH CUTTING FLUID CONTROL SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GUN MOUNTS	CUTTING FLUID PERFORMANC E

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8043	ARMY	78		IMPROVED MACHINING PROCEDURES FOR DOVETAILS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON BARRELS	BROACHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8047	ARMY	80 78		PASS THRU STEADY RESTS FOR TUBE TURNING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	TURNING FIXTURING

METAL REMOVAL

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***
        EFFORT NO   SERVICE     YEARS OF
***                             FUNDING     STATUS   TITLE
*       6 8341      ARMY          80                 HOLLOW CYLINDER CUT OFF MACHINE
*                                 81

***                 MATERIAL           APPLICATION        COMPONENT                 SPECIFIC PROCESS
*                   STEEL              WEAPONS            CANNON TUBES              ROTATING CUTTER CUT OFF
--------------------------------------------------------------------------------

        EFFORT NO   SERVICE     YEARS OF
***                             FUNDING     STATUS   TITLE
*       6 8103      ARMY          82                 HIGH VELOCITY MACHINING
*                                 81
*                                 84

***                 MATERIAL           APPLICATION        COMPONENT                 SPECIFIC PROCESS
*                   STEEL              WEAPONS            CANNON TUBE               TURNING
--------------------------------------------------------------------------------

        EFFORT NO   SERVICE     YEARS OF
***                             FUNDING     STATUS   TITLE
*       6 8025      ARMY          79                 ELECTRONIC PROFILE READOUT GAGE FOR POWDER CHAMBERS

***                 MATERIAL           APPLICATION        COMPONENT                 SPECIFIC PROCESS
*                   STEEL              WEAPONS            LARGE CALIBER             GRINDING
*                                                                                   IN PROCESS INSPECTION
*                                                         TUBES
--------------------------------------------------------------------------------

        EFFORT NO   SERVICE     YEARS OF
***                             FUNDING     STATUS   TITLE
*       6 7802      ARMY          79                 ESTABLISH MACHINE TOOL PERFORMANCE SPECIFICATIONS
*                                 78

***                 MATERIAL           APPLICATION        COMPONENT                 SPECIFIC PROCESS
*                   STEEL              WEAPONS            GENERAL                   MACHINE TOOL TESTING
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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7715	ARMY	77		APPLICATION OF CONTROLLED-FORCE MACHINING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GENERAL	BORING MILLING DRILLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7707	ARMY	77		AUTOMATED PROCESS CONTROL FOR MACHINING-CAM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GENERAL	MACHINEABILITY DATA COMPUTERIZE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7652	ARMY	77		APPLICATION OF COOLANT CHIP EJECTOR TOOLING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER RECOIL MECHANISMS	DRILLING SIZING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7485	ARMY	77		APPLICATION OF CHEMICAL PROCESSES TO IMPROVE SURFACE FINISH

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	ELECTROPOLISHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7482	ARMY	79		MODIFIED RIBBON RIFLING GENERATING MACHINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	DUAL RIFLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7317	ARMY	79		OPTIMIZATION OF STEP THREAD TOOLING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER BREECH MECHANISMS	TOOL DESIGN

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7246	ARMY	79		SIMPLIFICATION OF BREECH RING MANUFACTURING AND HANDLING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER BREECH MECHANISMS 105MM M68 BREECH RING	FIXTURING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7825	ARMY	78		ELIMINATION OF FACILITATING HONING OPERATIONS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	BORING TOOL GEOMETRY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7711	ARMY	77		ELECTROPOLISHING PROCESSES FOR ARMAMENT COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	SMALL CALIBER BARRELS	ELECTROPOLISHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8162	ARMY	81 82		IMPROVED SC GUN BARREL RIFLING MFG TECHNIQUES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARREL,GUN,SC	BROACHING,ULTRASONIC

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8164	ARMY	81 82 83		HIGH SPEED MACHINING OF SC WEAPON COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	SMALL CALIBER MPTS	MACHINING, HIGH SPEED

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8135	ARMY	81 82		IN-PROCESS CONTROL OF MACHINING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	RECOIL CYCLINDERS	IN PROCESS INSPECTION TURNING MILLING

METAL REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7928	ARMY	80 81	NU	ROBOTIZED BENCHING OPERATIONS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON BREECH BLOCKS BREECH RINGS	BENCHING ROBOTS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8151	ARMY	81 82		PORTABLE ENGRAVING SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON	ENGRAVING, PORTABLE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8057	ARMY	80		DUAL RIFLING BROACH REMOVAL SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON, 105MM GUN, M68	BROACHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00752	NAVY	80	NU	MANUFACTURE OF CURVED COOLING HOLES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES	ECM

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00700	NAVY	81		HIGH TEMPERATURE HIGH STRENGTH LAMINATE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	FLUIDIC CONTROLS	MACHINING PLATING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M280	AIR FORCE	80 81	NU	MT FOR ADVANCED METAL REMOVAL TECHNIQUES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES	TURNING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7156	ARMY	76		ULTRASONICALLY ASSISTED MACHINING FOR SUPERALLOYS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	ROTOR SYSTEM MISC COMPONENTS	MACHINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7103	ARMY	77 76		BLISK AND IMPELLER MFG BY AUTOMATIC MULT-SPINDLE MACHINING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	COMPRESSOR BLISK	MILL, 4 SPINDLE, 5 AXIS ABRASIVE PARTICLE FLOW

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7366	ARMY	81 82		SPIRAL SELF-ACTING SEAL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES SPIRAL GROOVE SEAL	METAL REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M254	AIR FORCE	78		MT FOR AUTOMATED ECM BORE ENTRY DISK FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	DISKS TURBINE ENGINES	ECM, AUTOMATION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 6008	ARMY	81 82		LASER ASSISTED MACHINING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	LAND VEHICLES	TURBINE ENGINES XM1	MACHINING, LASER ASSISTE D

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7248	ARMY	81 82		CLOSED LOOP MACHINING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES MID-FRAME	TURNING IN-PROCESS CONTROL

METAL REMOVAL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M246	AIR FORCE	78		MT FOR PRODUCTION MACHINABILITY DATA AND DATA BASE STRUCTURE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRFRAME STRUCTURES	DATA GENERATION

METAL REMOVAL

FUTURE SUBCOMMITTEE ACTIVITIES

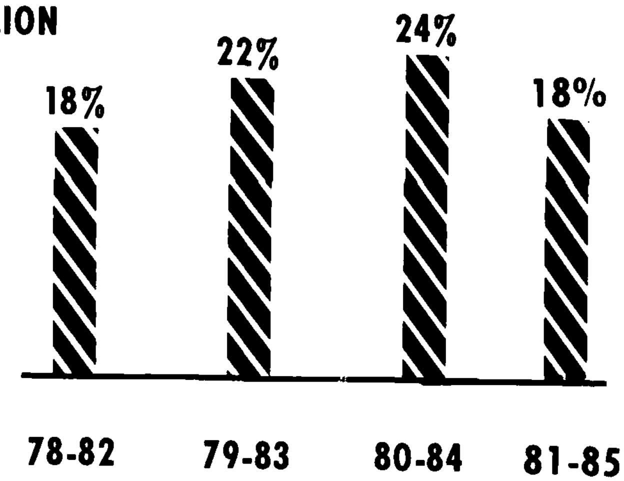
- INVESTIGATE POSSIBILITY OF JOINT ARMY/AIR FORCE PROGRAM FOR LASER ASSISTED MACHINING
- INVESTIGATE POSSIBILITY OF JOINT ARMY/AIR FORCE PROGRAM FOR IN-PROCESS INSPECTION AND CONTROL
- INVESTIGATE POSSIBILITY OF JOINT ARMY/AIR FORCE PROGRAM FOR HIGH SPEED MACHINING OF ALUMINUM

THE ARMY AND AIR FORCE WILL MEET TO DISCUSS THE POSSIBILITIES OF FORMING JOINT PROGRAMS FOR LASER ASSISTED MACHINING, IN-PROCESS INSPECTION AND CONTROL, AND HIGH SPEED MACHINING OF ALUMINUM.

JOINING

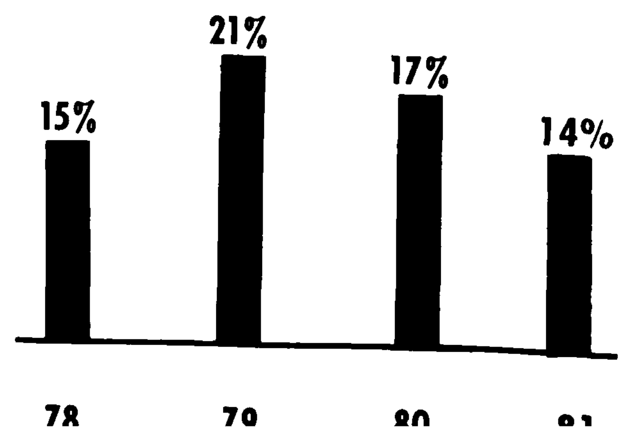
FIVE YEAR FUNDING FORECAST ● 42-46 MILLION

COMPARISON OF FIVE YEAR PLANS



FISCAL YEARS

COMPARISON OF INDIVIDUAL YEAR PROGRAMS



FISCAL YEAR

IN THE JOINING AREA, THE FIVE YEAR FORECAST PROJECTS EXPENDITURES OF BETWEEN 42 TO 46 MILLION DOLLARS. THE COMPARISON OF THE FIVE YEAR PLANS SHOWS THE BEGINNING OF A DECREASE IN THE LEVEL OF EFFORT FOR JOINING. THIS IS ALSO EVIDENT IN THE COMPARISON OF THE INDIVIDUAL YEAR PROGRAMS. WHETHER THIS TREND WILL CONTINUE IS UNCLEAR.

JOINING

TECHNICAL OBJECTIVES

- REDUCE FILLER MATERIAL USAGE
- INCREASE DESIGN FLEXIBILITY
- INCREASE SERVICE LIFE
- INCREASE DEPOSITION RATES
- REDUCE DISTORTION
- INCREASE THE DEGREE OF AUTOMATION

THE TECHNICAL OBJECTIVES BEING SOUGHT IN JOINING ARE TO REDUCE FILLER MATERIAL USAGE, INCREASE DESIGN FLEXIBILITY, INCREASE SERVICE LIFE, INCREASE DEPOSITION RATES, REDUCE DISTORTION AND INCREASE THE DEGREE OF AUTOMATION.

JOINING

FREQUENCY	SPECIFIC PROCESS
1	ACOUSTIC EMISSION INSPEC
3	ARC FUSION PROCESSES
1	BONDING, ADHESIVE
5	BONDING, DIFFUSION
1	BONDING, DIFFUSION, SEAM
3	BONDING, HIP
1	BONDING, PRESSURE
6	BRAZING
1	MECHANICAL JOINING
2	POWDER METAL FILLER
1	REPAIR OF SPF/DB PANELS
1	SOLDERING, VAPOR
1	WELDBOND
1	WELDING BI-METAL STRIPS
5	WELDING, EB
1	WELDING. EXPLOSIVE
3	WELDING, INERTIA
3	WELDING, LASER
3	WELDING, MIG
1	WELDING, NARROW GAP
1	WELDING, PLASMA
1	WELDING, RESISTANCE
2	WELDING, SUBMERGED ARC
3	WELDING, TIG
1	WELDING, ULTRASONIC

THE SPECIFIC JOINING PROCESSES AND THE NUMBER OF PROJECTS INVOLVED IN EACH PROCESS ARE SHOWN ON THIS CHART.

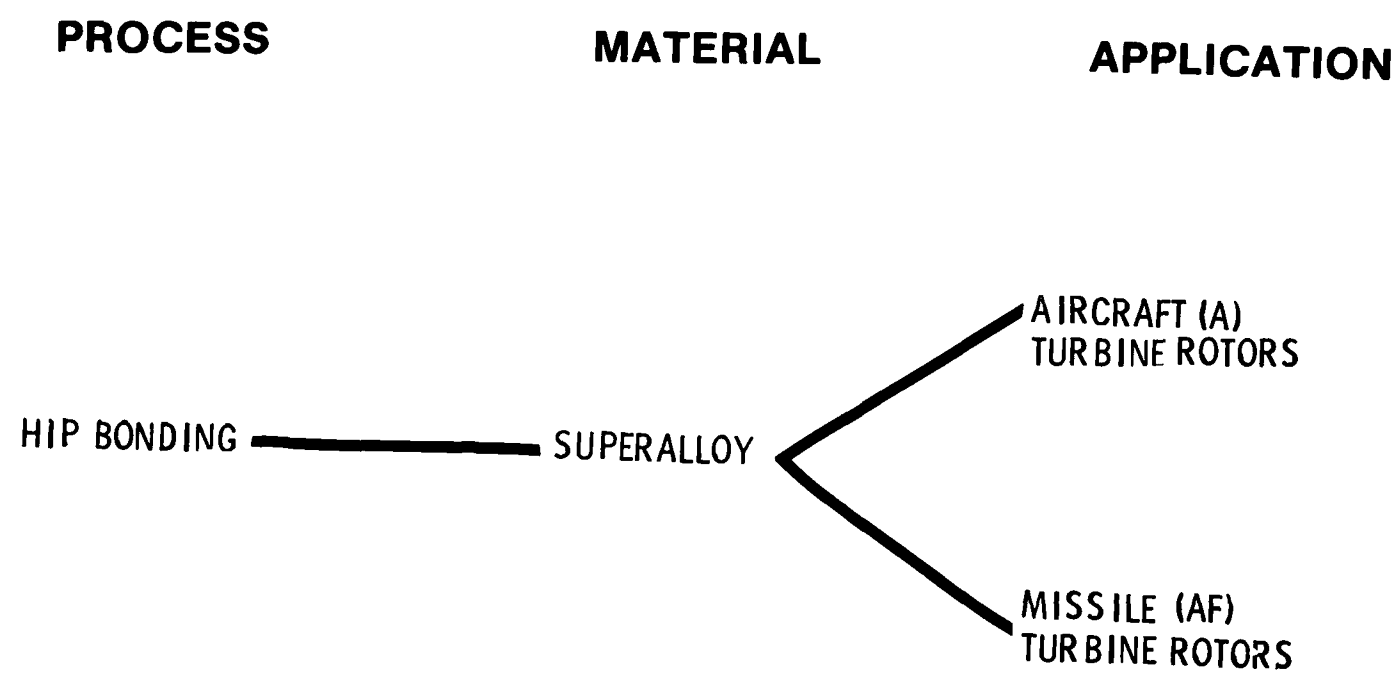
JOINING

FY81 PROGRAM REVIEW

- 20 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - HIP BONDING
  - DIFFUSION BONDING
  - AUTOMATION OF CONVENTIONAL WELDING
  - HIGH ENERGY BEAM WELDING

THE SUBCOMMITTEE REVIEWED 20 FY81 PROJECTS AND IDENTIFIED HIP BONDING, DIFFUSION BONDING, AUTOMATION OF CONVENTIONAL WELDING, AND HIGH ENERGY BEAM WELDING AS THE COMMON AREAS OF INTEREST AMONG THE SERVICES.

JOINING



PROCESS
MATERIAL
APPLICATION
HIP BONDING
SUPERALLOY
AIRCRAFT (A)
TURBINE ROTORS
MISSILE (AF)
TURBINE ROTORS

THE ARMY AND AIR FORCE ARE ESTABLISHING HIP BONDING AS A METHOD FOR FABRICATING DUAL PROPERTY ROTORS.

JOINING

PROCESS	MATERIAL	APPLICATION
DIFFUSION BONDING	SUPERALLOY	TURBINE BLADE TIPS (N) (AF)
		TRANSPIRATION COOLED COMPONENTS (A) (AF)

THE NAVY AND AIR FORCE ARE JOINTLY PURSUING A PROGRAM FOR APPLYING TIPS TO TURBINE BLADES. THE ARMY AND AIR FORCE ARE JOINTLY PURSUING A PROGRAM FOR MAKING TRANSPIRATION COOLED COMPONENTS.

JOINING

PROCESS	MATERIAL	APPLICATION
AUTOMATION OF CONVENTIONAL WELDING PROCESSES	STEEL	SHIPS (N) ARMOR (A)

WHILE THE NAVY AND ARMY ARE PROPOSING DIFFERENT PROGRAMS DEALING WITH AUTOMATION OF CONVENTIONAL WELDING PROCESSES, THESE PROGRAMS OFFER AN OPPORTUNITY TO POSSIBLY DEVELOP A JOINT PROGRAM.

AD-A085 756 ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY ROCK ISLAND IL F/G 11/6
METALS SUBCOMMITTEE REPORT - MANUFACTURING TECHNOLOGY ADVISORY --ETC(U)
JAN 80 G NEY

UNCLASSIFIED NL

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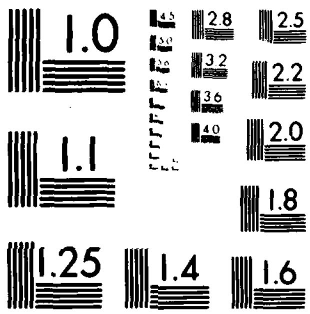
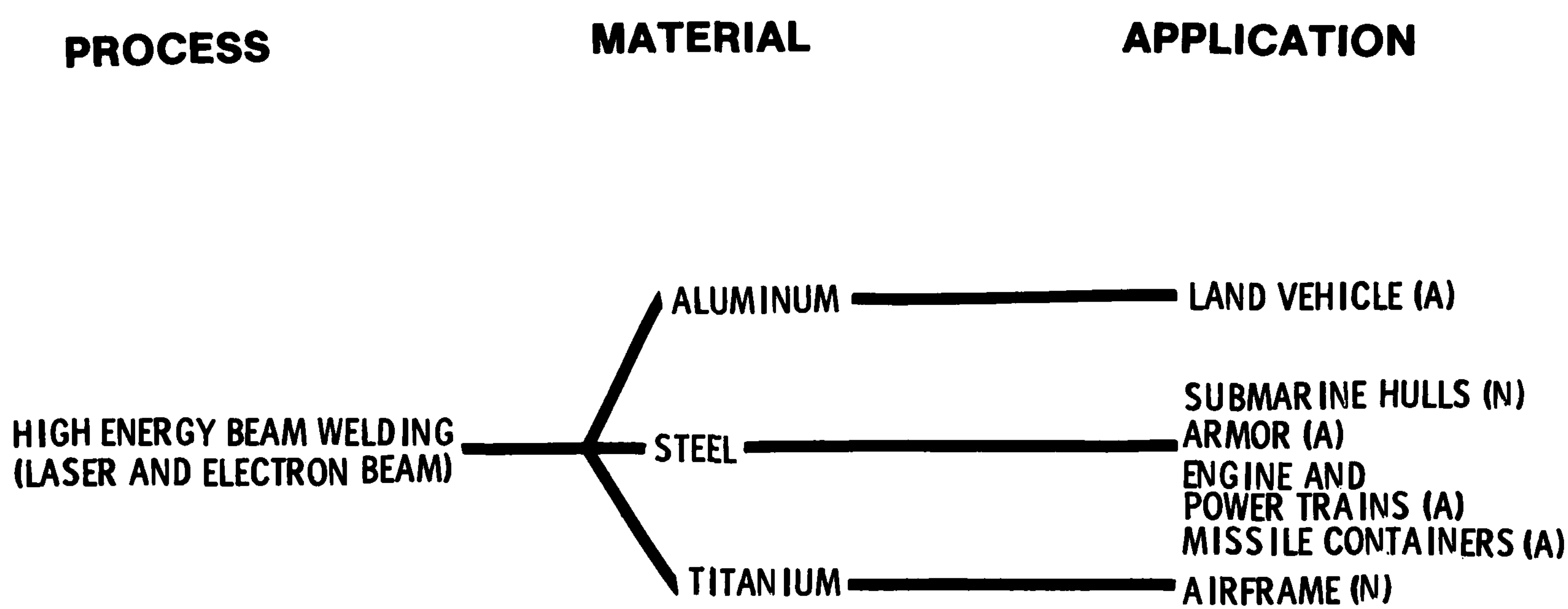


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

JOINING


PROCESS
MATERIAL
APPLICATION
HIGH ENERGY BEAM WELDING
(LASER AND ELECTRON BEAM)
ALUMINUM
STEEL
TITANIUM
LAND VEHICLE (A)
SUBMARINE HULLS (N)
ARMOR (A)
ENGINE AND
POWER TRAINS (A)
MISSILE CONTAINERS (A)
AIRFRAME (N)

VARIOUS PROJECTS ARE BEING PURSUED IN THE APPLICATION OF LASER AND ELECTRON BEAM WELDING. IN OUR REVIEW WE FOUND NO DUPLICATION OF EFFORT.

JOINING

FY80 PROGRAM CHANGES REVIEW

- 4 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED 4 NEW FY80 PROJECTS AND IDENTIFIED NO NEW COMMON AREAS THAT HAD NOT ALREADY BEEN IDENTIFIED IN THE REVIEW OF THE FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT LISTS ALL ACTIVE, APPORTIONMENT, AND BUDGET PROJECTS WHICH HAVE BEEN CLASSIFIED AS JOINING. THE PROJECTS HAVE BEEN SORTED BY THE MATERIALS BEING JOINED AND BY ITS APPLICATION.

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7055	ARMY	78		ULTRASONIC WELDING OF HELICOPTER FUSELAGE STRUCTURES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAME SECONDARY STRUCTURES	WELDING, ULTRASONIC

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M208	AIR FORCE	80 79 78		MT FOR PRODUCTION DEMONSTRATION OF A-10 WELDBOND

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES FUSELAGE MID SEC PANELS COCKPIT SIDE PANELS	WELDBOND

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
ONS00551	NAVY	81		PICLE BATTERY FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	BATTERY, TORPEDO BARRIER	COATING, EPOXY GLUE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5088	ARMY	79 80		HIGH POWER ELECTRON BEAM WELDING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	LAND VEHICLES	HULL	WELDING, EB

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5091	ARMY	80 81		HEAVY ALUMINUM PLATE FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	LAND VEHICLES	HULL	WELDING, EB WELDING, MIG WELDING, TIG

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
92M229	AIR FORCE	79		MT FOR ALUMINUM HEAT EXCHANGES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	MISSILES	HEAT EXCHANGERS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DN800665	NAVY	81		ALUMINUM MIG ARGON-OXYGEN GAS MIXTURE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	SHIPS	SUPERSTRUCTURE	WELDING, MIG

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00651	NAVY	80		HIGH PRODUCTION FLUIDIC CIRCUIT MANUFACTURE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
BRASS	AIRCRAFT	FLUIDIC CONTROL SYSTEMS	BONDING, DIFFUSION BRAZING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8035	ARMY	80 81		COATING TUBE SUPPORT SLEEVES WITH BEARING MATERIALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
BRONZE	WEAPONS	GUN MOUNTS	WELDING, MIG BRAZING, INDUCTION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00642	NAVY	79		BATCH VAPOR SOLDERING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	SHIPS	PC BOARDS FLEXIBLE WIRING	SOLDERING, VAPOR

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7114	ARMY	77		IMPROVED MFG TECH FOR INFARED SUPPRESSION ON AIRCRAFT

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TURBINE ENGINES INFARED SUPPRESSOR	BRAZING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7326	ARMY	82 81		ELECTRON BEAM/INERTIA WELD REPAIR SPLINE SHAFTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	GEAR/SPLINE REPAIR TRANSMISSIONS	EB WELDING WELDING, INERTIA

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***
                                 YEARS OF
     EFFORT NO    SERVICE        FUNDING     STATUS   TITLE
***
*    DN800537     NAVY             81                 HIGH FREQUENCY RESISTANCE WELDING

                   MATERIAL            APPLICATION          COMPONENT                     SPECIFIC PROCESS
***
*                  STEEL               AMMUNITION           SHELL, TORPEDO                WELDING, RESISTANCE
-------------------------------------------------------------------------------------

                                 YEARS OF
     EFFORT NO    SERVICE        FUNDING     STATUS   TITLE
***
*    18M139       AIR FORCE        81                 MT FOR HARD STRUCTURE MUNITION WARHEAD

                   MATERIAL            APPLICATION          COMPONENT                     SPECIFIC PROCESS
***
*                  STEEL               AMMUNITION           WARHEAD
*                                                           STRUCTURE HARD
-------------------------------------------------------------------------------------

                                 YEARS OF
     EFFORT NO    SERVICE        FUNDING     STATUS   TITLE
***
*    5 4444       ARMY             79                 BODY FOR M42/M46 GRENADE
*                                  78
*                                  7T

                   MATERIAL            APPLICATION          COMPONENT                     SPECIFIC PROCESS
***
*                  STEEL               AMMUNITION           METAL PARTS                   FORGING, COLD
*                                                                                         BRAZING
*                                                           PROJECTILES
-------------------------------------------------------------------------------------

                                 YEARS OF
     EFFORT NO    SERVICE        FUNDING     STATUS   TITLE
***
*    5 6725       ARMY             78                 AUTOMATED INERTIA BANDING MACHINE FOR ARTILLERY MUNITIONS

                   MATERIAL            APPLICATION          COMPONENT                     SPECIFIC PROCESS
***
*                  STEEL               AMMUNITION           METAL PARTS                   WELDING, INERTIA
*                                                                                         AUTOMATION
*                                                           PROJECTILES
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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
S 6642	ARMY	76		INERTIA WELDED ROTATING BANDS FOR PROJECTILE BODIES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	METAL PARTS PROJECTILES ROTATING BANDS	WELDING, INERTIA

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 6007	ARMY	82 81		SUBMERGED ARC WELDING USING POWDERED METALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	ARMOR	WELDING, SUBMERGED ARC POWDER METAL FILLER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 6053	ARMY	84 81 85 83 82		WELDING SYSTEMS INTEGRATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	ARMOR	ARC FUSION PROCESSES AUTOMATION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 6038	ARMY	79		HIGH DEPOSITION WELDING PROCESSES FOR ARMOR

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	ARMOR	WELDING, SUBMERGED ARC POWDER METAL FILLER

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***
                                YEARS OF
    EFFORT NO    SERVICE        FUNDING     STATUS    TITLE
***
*   T 4575       ARMY              79                 LASER WELDING TECHNIQUES FOR MILITARY VEHICLES
*                                  78

                  MATERIAL            APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*                 STEEL               LAND VEHICLES       ARMOR                      WELDING, LASER
------------------------------------------------------------------------------------------

                                YEARS OF
    EFFORT NO    SERVICE        FUNDING     STATUS    TITLE
***
*   T 4557       ARMY              77                 HIGH EFFICIENCY JOINING OF ESR ARMOR

                  MATERIAL            APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*                 STEEL               LAND VEHICLES       ARMOR                      WELDING
------------------------------------------------------------------------------------------

                                YEARS OF
    EFFORT NO    SERVICE        FUNDING     STATUS    TITLE
***
*   T 4392       ARMY              76                 JOINING DISSIMILAR METALS

                  MATERIAL            APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*                 STEEL               LAND VEHICLES       HULL/BODY ARMOR            WELDING BI-METAL STRIPS
------------------------------------------------------------------------------------------

                                YEARS OF
    EFFORT NO    SERVICE        FUNDING     STATUS    TITLE
***
*   T 5085       ARMY              78                 PROD TECH FOR FAB OF TURBINE ENGINE RECUPERATOR
*                                  77

                  MATERIAL            APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*                 STEEL               LAND VEHICLES       TURBINE ENGINES            WELDING, LASER
*                                                         RECUPERATOR
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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
R 1052	ARMY	81		ACOUSTIC EMISSION OF MOTOR CASES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	MISSILES	ROCKET MOTOR CASES	ACOUSTIC EMISSION INSPEC

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
R 3441	ARMY	78 79		APPLICATION OF HIGH ENERGY LASER MANUFACTURING PROCESSES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	MISSILES	MISSILE CONTAINERS	WELDING, LASER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00274	NAVY	80	NU	COMPUTERIZED WELDING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULLS	ARC FUSION PROCESSES AUTOMATION COMPUTER CONTROL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00388	NAVY	81		SLAG/FLUX WELD SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULLS	ARC FUSION PROCESSES

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00405	NAVY	79		NARROW GAP WELDING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	DECKS	WELDING, NARROW GAP

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00591	NAVY	80		MECHANIZED MATERIAL APPLICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULLS RUBBER TILES	BONDING, ADHESIVE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00650	NAVY	81		MAGNETIC FURMING MACHINE FOR ROLLING BOILER TUBES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	SHIP BOILERS TUBES	MECHANICAL JOINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00666	NAVY	81		MULTIPLE MODE WELDING SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	STRUCTURES	WELDING

JOINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00687	NAVY	80	NU	DISSIMILAR METAL PIPE PENETRATORS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	PIPE PENETRATORS	WELDING, EXPLOSIVE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M125	AIR FORCE	80 82		MT FOR JOINING OF PM DISKS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES COMPRESSOR ROTOR	BONDING, DIFFUSION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00747	NAVY	80		CORROSION RESISTANT TURBINE BLADE TIPS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE BLADES	BONDING, DIFFUSION WELDING, TIG

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91M262	AIR FORCE	79	NU	MT FOR REPAIR OF KNIFE EDGE SEALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES SEALS KNIFE EDGE ROTOR COMPRESSOR	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M208	AIR FORCE	82 81 83		MT FOR TRANSPORATION COOLED AIRFOILS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	VANES BLADES TURBINE ENGINES	BONDING, HIP ETCHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
02M205	AIR FORCE	80 81	NU	MT FOR ADVANCED VANE AND COMBUSTOR FABRICATION FOR SMALL ENGINES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES VANES TURBINE COMBUSTOR	BRAZING WELDING BONDING, DIFFUSION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M207	AIR FORCE	80 81		MT FOR ABRASIVE BLADE TIPS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADE TURBINE	JOINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7197	ARMY	80 77 79 81		FABRICATION OF INTEGRAL ROTORS BY JOINING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES ROTORS	BONDING, HIP

JOINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7086	ARMY	79 78		ABRADABLE SEALS FOR TURBINE BLADES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES TURBINE BLADES	BONDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7322	ARMY	81 82 83		LOW COST TRANSPIRATION-COOLED COMBUSTOR LINER

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES COMBUSTOR	BONDING, DIFFUSION PHOTO ETCHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M245	AIR FORCE	81 82		MT FOR REAIR OF ODS COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADES VANES	BRAZING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
72M269	AIR FORCE	77 79		MT FOR DUAL PROPERTY INTEGRAL TURBINE WHEEL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	MISSILES	TURBINE ENGINES WHEEL TURBINE	CASTING PM BONDING, HIP

JOINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M113	AIR FORCE	83 82 81		MT FOR SCALE-UP OF NON-COBALT WELDABLE ALLOYS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOYS	AIRCRAFT	TURBINE ENGINES BLADES VANES	WELDING, TIG WELDING, PLASMA WELDING, EB

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00680	NAVY	79		EB WELDED HIP STRUCTURES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRFRAME STRUCTURES NACELLE	EB WELDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M219	AIR FORCE	81		MT FOR REPAIR OF SPF/DB PANELS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	DOOR,MAIN LANDING STRUT	REPAIR OF SPF/DB PANELS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7054	ARMY	76		DIFFUSION BONDED TITANIUM SPAR FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	ROTOR SYSTEM BLADE/SPAR	BONDING, DIFFUSION, SEAM

JOINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
51M871	AIR FORCE	75 76		MT FOR SHROUDED BLADE FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENG BLADES	BONDING, PRESSURE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M833	AIR FORCE	78		MT FOR WELDED TITANIUM LANDING GEAR BOGIE BEAM FOR C-141

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	BOGIE BEAM	WELDING

JOINING

SUBCOMMITTEE ACCOMPLISHMENTS

- ASSESSED THE RESULTS OF THE JOINING CONFERENCE
- ESTABLISHED A JOINT NAVY/AIR FORCE PROGRAM FOR TURBINE BLADE TIP TREATMENT
- ESTABLISHED A JOINT ARMY/AIR FORCE PROGRAM FOR TRANSPIRATION COOLED COMPONENTS

FUTURE SUBCOMMITTEE ACTIVITY

- INVESTIGATE THE POSSIBILITY OF A JOINT ARMY/NAVY PROGRAM ON AUTOMATION OF CONVENTIONAL WELDING PROCESSES
- INVESTIGATE THE POSSIBILITY OF SPONSORING A WORKSHOP ON LASER MANUFACTURING TECHNOLOGY

THE SUBCOMMITTEE ASSESSED THE RESULTS OF THE JOINING CONFERENCE WHICH IT SPONSORED IN SEPTEMBER 1978. THAT ASSESSMENT IS PRESENTED ON THE NEXT CHART. THE SUBCOMMITTEE WAS RESPONSIBLE FOR CREATING A JOINT NAVY/AIR FORCE PROGRAM FOR TURBINE BLADE TIP TREATMENT AND A JOINT ARMY/AIR FORCE PROGRAM FOR TRANSPIRATION COOLED COMPONENTS.

THE SUBCOMMITTEE WILL INVESTIGATE THE POSSIBILITY OF A JOINT ARMY/NAVY PROGRAM FOR THE AUTOMATION OF CONVENTIONAL WELDING PROCESSES AND WILL INVESTIGATE THE POSSIBILITY OF SPONSORING OUR SECOND WORKSHOP ON LASER MANUFACTURING TECHNOLOGY. IT HAS BEEN TWO AND A HALF YEARS SINCE WE SPONSORED THE FIRST; AND GREAT PROGRESS HAS BEEN MADE IN THIS TECHNOLOGY SINCE THEN. BUT TWO QUESTIONS NEED TO BE ANSWERED BEFORE WE MAKE A FINAL DECISION. FIRST, IS THE WORKSHOP NEEDED? BECAUSE OF THE INTEREST IN THIS TECHNOLOGY, THERE HAVE BEEN AND CONTINUE TO BE WORKSHOPS AND SEMINARS HELD ON THIS SUBJECT ON A REGULAR BASIS. WHAT CAN WE ACCOMPLISH THAT THESE OTHER MEETINGS CANNOT? THE SECOND QUESTION STEMS FROM THE RECOMMENDATIONS MADE AT THE JOINING WORKSHOP. SHOULD WE EXPAND THE SUBJECT MATTER TO ALL HIGH ENERGY BEAM PROCESSES, AS THE WORKSHOP RECOMMENDED, OR WILL THIS EXPANSION IN SCOPE BE TOO MUCH TO HANDLE AT ONE WORKSHOP. THE ANSWERS TO THESE QUESTIONS WILL DETERMINE WHAT WE WILL DO.

JOINING TECHNOLOGY WORKSHOP

ISSUES AND ACTIONS TAKEN

- TOO MUCH EMPHASIS BEING PLACED ON HIGH ENERGY BEAM TECHNOLOGY
  - SEVERAL NEW PROGRAMS DEALING WITH CONVENTIONAL WELDING PROCESSES HAVE BEEN PROPOSED
- AUTOMATION OF CONVENTIONAL WELDING PROCESSES IS A DESIREABLE GOAL
  - DOD IS NOW PURSUING THIS GOAL
- NEED INCREASED R&D FOR JOINING TECHNOLOGY
  - R&D PROGRAMS ARE BEING FUNDED PARTICULARLY FOR BETTER UNDERSTANDING OF CONVENTIONAL WELDING PROCESS
- NEED MORE DESIGN AND PROCESSING DATA
  - DESIGN ALLOWABLE DATA FOR ALUMINUM WELDMENTS
  - WELD REPAIR FOR TITANIUM CASTINGS

THE JOINING TECHNOLOGY WORKSHOP WAS HELD IN SEPTEMBER OF LAST YEAR. ALL WORKSHOP PANELS FELT THAT DOD WAS PLACING TOO MUCH EMPHASIS ON HIGH ENERGY BEAM WELDING TECHNOLOGIES. THIS SUGGESTION WAS APPARENTLY NOTED BY DOD PERSONNEL IN ATTENDANCE. NO NEW HIGH ENERGY BEAM PROJECTS ARE PLANNED FOR FY80 OR FY81, AND SEVERAL CONVENTIONAL WELDING PROGRAMS HAVE BEEN PROPOSED.

THE PANELS RECOMMENDED THE GOAL OF AUTOMATING CONVENTIONAL WELDING PROCESSES. ARMY AND NAVY PROJECTS ARE NOW INCLUDED IN THE PROGRAM WITH THIS GOAL.

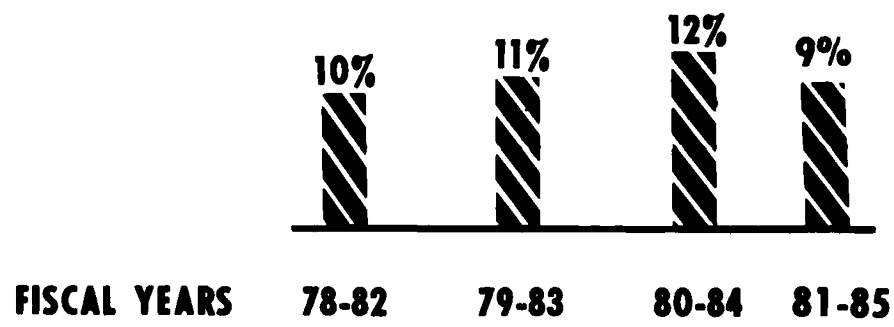
ALSO POINTED OUT WAS THE NEED FOR INCREASED R&D FUNDING FOR DEVELOPING MORE WELDABLE ALLOYS AND UNDERSTANDING THE WELDING PROCESSES THEMSELVES. R&D PROGRAMS ARE NOW BEING PURSUED TO EXPAND OUR UNDERSTANDING OF CONVENTIONAL WELDING PROCESSES.

THE NEED FOR DESIGN AND PROCESSING DATA WAS ALSO HIGHLIGHTED. SUCH EFFORTS ARE NOW BEING PLANNED BY THE ARMY AND THE NAVY.

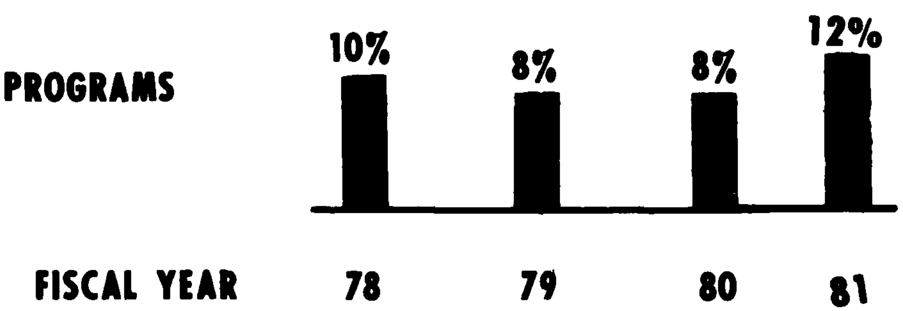
SURFACE TREATMENT

FIVE YEAR FUNDING FORECAST • 18-22 MILLION

COMPARISON OF FIVE YEAR PLANS



COMPARISON OF INDIVIDUAL YEAR PROGRAMS



IN THE SURFACE TREATMENT AREA, THE FIVE YEAR FUNDING FORECAST PROJECTS EXPENDITURES OF 18 TO 22 MILLION DOLLARS. THE COMPARISON OF THE FIVE YEAR PLANS SHOWS A CONSTANT LEVEL OF EFFORT AS DOES THE COMPARISON OF INDIVIDUAL YEAR PROGRAMS.

SURFACE TREATMENT

TECHNICAL OBJECTIVES

- INCREASE DIFFUSION/DEPOSITION RATES
- REDUCE ENERGY CONSUMPTION
- REDUCE POLLUTANTS
- PROVIDE PROCESSES FOR ADVANCED COATINGS
- INCREASE CORROSION AND WEAR RESISTENCE

THE TECHNICAL OBJECTIVES BEING SOUGHT IN THE SURFACE TREATMENT AREA ARE TO INCREASE THE DIFFUSION/DEPOSITION RATES, REDUCE ENERGY CONSUMPTION, REDUCE POLLUTANTS, PROVIDE PROCESSES FOR ADVANCED COATINGS AND INCREASE CORROSION AND WEAR RESISTANCE.

SURFACE TREATMENT

FREQUENCY	SPECIFIC PROCESS
1	ABRASIVE PARTICLE FLOW
2	ANODIZING
1	AQUAQUENCH
1	ARC WELD HARD FACING
1	AUTOFRETTAGE
1	CARBORIZING, VACUUM
2	CLEANING SURFACE
9	COATING
1	DEPOSITION
1	ELECTRODE STRAIGHTNESS
1	ELECTRODEPOSITION
1	ELECTROPLATE, ALUMINIDE,
5	HEAT TREATMENT
1	HEAT TREATMENT, CONT.
4	HEAT TREATMENT, LASER
1	MAKING MANDRELS
1	PLASMA SPRAY
2	PLATING
3	PLATING, CHROMIUM
1	PLATING, ION
1	QUENCHING
1	SHOT BLASTING
1	SPRAYING, THERMOARC
1	SPRAYING. ZR OXCIDE
1	STRESS RELIEF, VIBRATORY
1	SWAG AUTOFRETTAGE

THE SPECIFIC SURFACE TREATMENT PROCESSES AND THE NUMBER OF PROJECTS ASSOCIATED WITH EACH PROCESS IS SHOWN ON THIS CHART.

SURFACE TREATMENT

FY81 PROGRAM REVIEW

- 16 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - ION VACUUM DEPOSITION
  - LASER HEAT TREATMENT
  - PLASMA SPRAY

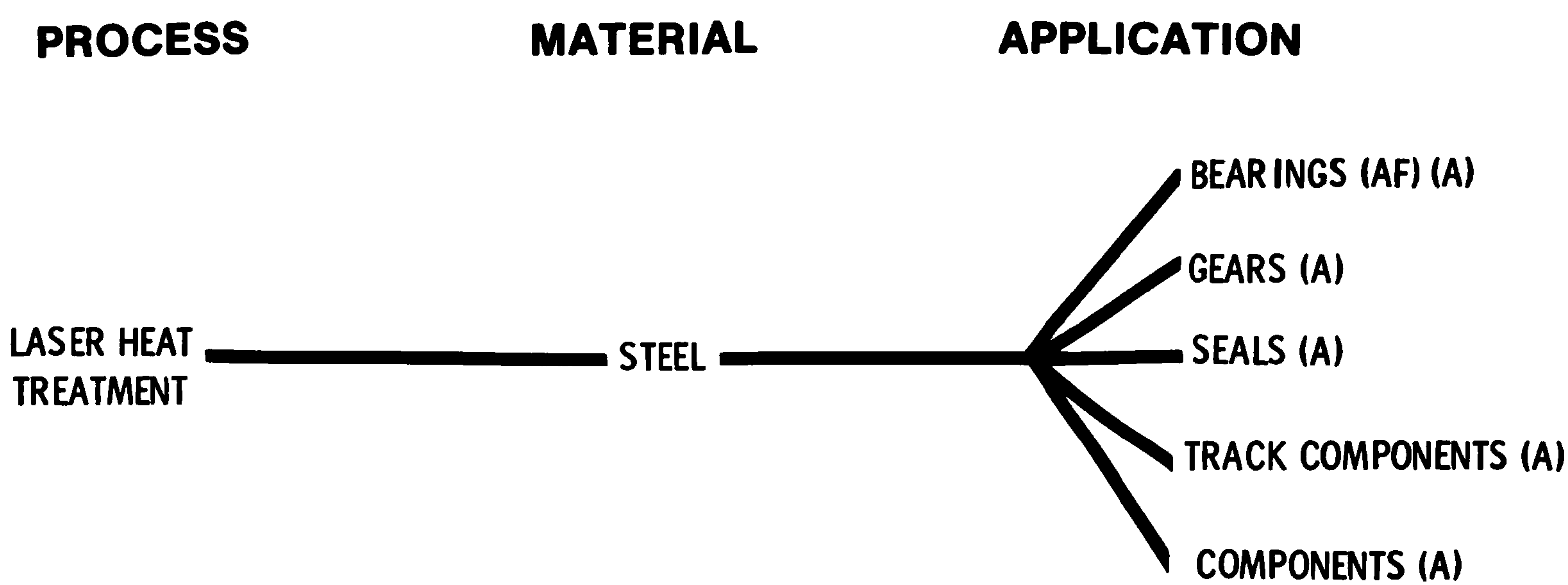
THE SUBCOMMITTEE REVIEWED 16 FY81 PROJECTS. ION VACUUM DESPOSITION, LASER HEAT TREATMENT AND PLASMA SPRAY WERE IDENTIFIED AS THE COMMON AREAS OF INTEREST AMONG THE SERVICES.

SURFACE TREATMENT

PROCESS	MATERIAL	APPLICATION
ION VACUUM DEPOSITION	STEEL	AIRFRAME STRUCTURES (AF) COMPONENTS (A) ARMAMENT

THE AIR FORCE ESTABLISHED THE ION VACUUM DEPOSITION PROCESS FOR APPLYING AN ALUMINUM COATING ON STEEL COMPONENTS FOR USING IN AIRFRAME STRUCTURES. THE ARMY'S EFFORT WILL EXTEND THE USE OF THIS PROCESS TO WEAPONS COMPONENTS.

SURFACE TREATMENT



THE ARMY AND AIR FORCE ARE JOINTLY PURSUING A PROGRAM FOR LASER HEAT TREATMENT OF BEARINGS. THE REST OF THE LASER HEAT TREATMENT PROGRAMS ARE ARMY'S AND ARE APPLYING THE TECHNOLOGY TO DIFFERENT MATERIALS AND CONFIGURATIONS.

SURFACE TREATMENT

PROCESS	MATERIAL	APPLICATION
PLASMA SPRAY	SUPERALLOY	AIR CRAFT (A) SEALS (AF)

THE ARMY AND AIR FORCE WILL MEET TO DISCUSS THE SEALS AREA TO INSURE THAT NO DUPLICATION OF EFFORT WILL TAKE PLACE.

SURFACE TREATMENT

FY80 PROGRAM CHANGES REVIEW

- 3 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED THREE NEW FY80 PROJECTS AND FOUND NO NEW COMMON AREAS THAT HAD NOT BEEN IDENTIFIED IN THE REVIEW OF FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT CONTAINS ALL ACTIVE, APPORTIONMENT AND BUDGET PROJECTS WHICH HAVE BEEN CLASSIFIED AS SURFACE TREATMENT. THEY HAVE BEEN SORTED FIRST BY MATERIAL AND NEXT BY APPLICATION.

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7644	ARMY	77		APPLICATION OF INTEGRAL COLOR ANODIZE FOR ALUMINUM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	WEAPONS	SMALL CALIBER	ANODIZING
		STOCK	
		RECEIVER	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8004	ARMY	80		CO-DEPOSITION OF SOLID LUBRICANTS DURING ANODIZING
		79		

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	WEAPONS	ALUMINUM LUBRICATED SURF	ANODIZING
		RECIEVERS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8113	ARMY	81		ESTABLISHMENT OF ION PLATING PROCESS FOR ARMAMENT PARTS
		82		

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	WEAPONS	RECEIVER	PLATING, ION
		FASTENERS	
		LINKS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
ONA81070	NAVY	81		THERMAL BARRIER COATING MFG PROCESS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
CERAMIC	AIRCRAFT	THERMAL BARRIERS	COATING
		TURBINE ENGINES	

SURFACE TREATMENT

***

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7143	ARMY	81 82		CERAMIC GAS SEAL-HIGH PRESSURE TURBINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
CERAMICS	AIRCRAFT	HPT SEALS	SPRAYING, ZR OXCIDE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA81069	NAVY	81		COMPRESSOR SEAL SCALE UP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AIRCRAFT	TURBINE ENGINES SEALS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M206	AIR FORCE	80		MT FOR PRODUCTION SCALE-UP OF 2500 F SEAL SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AIRCRAFT	TURBINE ENGINES SHROUD TURBINE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 8129	ARMY	75		COLUMBIUM ALLOY DYNAMIC TURBINE ENGINE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHEP	AIRCRAFT	TURBINE ENGINES BLADES	COATING OF COLUMBIUM

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 4309-09	ARMY	80	NU	INVESTIGATE METHODS FOR FORMING AND HEAT TREATING THE CORE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AMMUNITION	DEPLETED URANIUM CORE	HEAT TREATMENT FORGING, UPSET

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00349	NAVY	79		BOILER TUBE CLEANING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	SHIPS	TUBES, BOILER	CLEANING SURFACE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00667	NAVY	81		METAL TREATMENT PROCESS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	SHIPS	HULLS	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7746	ARMY	77		IMPROVED DURABILITY HIGH EFFICIENCY REFLECTIVE FILMS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	WEAPONS	FIRE CONTROL OPTICS	COATING

SURFACE TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7199	ARMY	78 79 80		SURFACE HARDENING OF GEARS BEARINGS AND SEALS BY LASERS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TRANSMISSION COMPONENTS	HEAT TREATMENT, LASER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7298	ARMY	80 79 81		HIGH TEMPERATURE VACUUM CARBURIZING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TRANSMISSION GEARS	CARBORIZING, VACUUM

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 8148	ARMY	76 75		PROCESSING ADVANCED GEAR MATERIALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	DRIVE SYSTEM GEARS	HEAT TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M232	AIR FORCE	78		MT FOR LASER HEAT TREATMENT OF BEARING RACES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT	TURBINE ENGINES BEARINGS	HEAT TREATMENT, LASER

SURFACE TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
18M237	AIR FORCE	81 82		MT FOR PLASMA SPRAYED BAND SEATS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	BAND SEATS	COATINGS PLASMA SPRAY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
S 6678	ARMY	77		EVALUATION OF AQUAQUENCH UNDER PRODUCTION CONDITIONS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	METAL PARTS PROJECTILES	AQUAQUENCH

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5054	ARMY	79 80		LASER SURFACE HARDENED COMBAT VEHICLE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	TRACK SHOES CONNECTORS TRACK PINS	HEAT TREATMENT, LASER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5086	ARMY	81 82		LASER HARDENING OF TRANSMISSION COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	TRANSMISSION COMPONENTS	HEAT TREATMENT, LASER

SURFACE TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 4514	ARMY	81 82		HARD FACING OF TRACK SHOES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	TRACK SHOE	ARC WELD HARD FACING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00355	NAVY	79		CO2 BLASTER

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULLS	SURFACE CLEANING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00648	NAVY	81		CO2 BLASTER

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULLS	SHOT BLASTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7213	ARMY	79 77		HIGH SPEED CHROMIUM PLATING TECHNIQUE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER TUBES	COATING PLATING, CHROMIUM

SURFACE TREATMENT

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***
    EFFORT NO   SERVICE     YEARS OF   STATUS   TITLE
                            FUNDING
***
*   6 7241      ARMY          76                IMPROVED HONING EQUIPMENT AND PROCEDURES

                 MATERIAL         APPLICATION        COMPONENT                  SPECIFIC PROCESS
***
*                STEEL            WEAPONS            LARGE CALIBER              HONING
*-------------------------------------------------------------------

    EFFORT NO   SERVICE     YEARS OF   STATUS   TITLE
                            FUNDING
***
*   6 7614      ARMY          77                APPLICATION OF RAPID PLATING BY ABRASIVE PARTICLE FLOW

                 MATERIAL         APPLICATION        COMPONENT                  SPECIFIC PROCESS
***
*                STEEL            WEAPONS                                       PLATING, CHROMIUM
*                                                                               ABRASIVE PARTICLE FLOW
*-------------------------------------------------------------------

    EFFORT NO   SERVICE     YEARS OF   STATUS   TITLE
                            FUNDING
***
*   6 7655      ARMY          78                APPLICATION OF THERMOARC SPRAY WEAR COATING
*                             77

                 MATERIAL         APPLICATION        COMPONENT                  SPECIFIC PROCESS
***
*                STEEL            WEAPONS            SMALL CALIBER              SPRAYING, THERMOARC
*                                                    STOCK
*                                                    RECEIVER
*-------------------------------------------------------------------

    EFFORT NO   SERVICE     YEARS OF   STATUS   TITLE
                            FUNDING
***
*   6 7733      ARMY          77                TUBE BREECH CLAMP

                 MATERIAL         APPLICATION        COMPONENT                  SPECIFIC PROCESS
***
*                STEEL            WEAPONS            LARGE CALIBER              AUTOFRETTAGE
*                                                    TUBES
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SURFACE TREATMENT

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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7814	ARMY	78 77		SYNTHETIC QUENCHANT FOR HEAT TREATING WEAPON COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GENERAL	HEAT TREATMENT QUENCHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7916	ARMY	81		APPLICATION OF LOW COST MANDREL MATERIALS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	SWAGE AUTOFRETTAGE MAKING MANDRELS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7920	ARMY	80		CONSERVATION OF CRITICAL MATERIALS FOR GUN TUBES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	HEAT TREATMENT FORGING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
M6 7940	ARMY	80 81		SYNERGISTIC PLATINGS WITH INFUSED LUBRICANTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LOW WEAR SURFACES LOW FRICTION SURFACES	PLATING

SURFACE TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8001	ARMY	80 81		RAPID FLOW PLATING OF SMALL CALIBER GUN TUBES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GUN TUBES, SMALL CALIBER	COATING PLATING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8005	ARMY	79		ESTABLISHMENT OF THE MECHANICAL PLATING PROCESS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GENERAL	DEPOSITION COATING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8026	ARMY	80		APPLICATION OF SYNTHETIC QUENCHANTS TO GUN TUBES AND HEAVY WEAPON COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARRELS, CANNON	HEAT TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8059	ARMY	80	NU	SALVAGE OF CANNON COMPONENTS BY ELECTRODEPOSITION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNONS	ELECTRODEPOSITION

SURFACE TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8119	ARMY	81 82		DIMENSIONAL STABILIZATION BY VIBRATORY ENERGY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	STRESS RELIEF, VIBRATORY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8152	ARMY	81		IMPROVED ANODE STRAIGHTNESS FOR CHROMIUM PLATING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	PLATING, CHROMIUM ELECTRODE STRAIGHTNESS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8153	ARMY	81 83		INCREASING GUN TUBE HEAT TREATMENT CAPACITY

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	HEAT TREATMENT, CONT.

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M212	AIR FORCE	79 80 78		MT FOR MCCRALY COATING PROCESS SCALEUP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADE TURBINE	COATING

SURFACE TREATMENT

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00745	NAVY	79		ELECTROPLATED ALUMINIDE COATING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADE	COATING ELECTROPLATE, ALUMINIDE,

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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M279	AIR FORCE	80 82	NU	MT FOR VACUUM PLASMO SPRAY OVERLAY COATINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M219	AIR FORCE	78 79		MT FOR WELD REPAIR SCALE UP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADES	CLEANING, FLUORIDE ION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 8017	ARMY	75		LEADING EDGE PROTECTIVE STRIP FOR MAIN ROTOR BLADES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	ROTOR BLADE LEADING EDGE STRIP	COATING

SURFACE TREATMENT

EFFORT NO	SFRVICE	YEARS OF FUNDING	STATUS	TITLE
71M779	AIR FORCE	79 78		MT FOR ALUMINIDE-PRODUCTION-COATING-PROCESS-SCALE-UP

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TI-ALUMINIDE	AIRCRAFT	TURBINE ENGINES TURBINE AIRFOILS	

SURFACE TREATMENT

SUBCOMMITTEE ACCOMPLISHMENTS

- INITIATED PLANS FOR DOD/INDUSTRY WORKSHOP ON PROTECTIVE COATINGS

FUTURE SUBCOMMITTEE ACTIVITIES

- INVESTIGATE THE POSSIBILITY OF A JOINT ARMY/AIR FORCE PROGRAM FOR HIGH TEMPERATURE TURBINE ENGINE SEALS
- SPONSOR TWO DOD/INDUSTRY WORKSHOPS ON PROTECTIVE COATINGS

THE SUBCOMMITTEE INITIATED PLANS FOR A DOD/INDUSTRY WORKSHOP ON PROTECTIVE COATINGS.

THE ARMY AND AIR FORCE WILL INVESTIGATE THE POSSIBILITY OF JOINTLY FUNDING AN EFFORT ON HIGH TEMPERATURE TURBINE ENGINE SEALS. BASED UPON THE PLANS THAT WERE ESTABLISHED, THE SUBCOMMITTEE HAS DECIDED TO BREAK THE PROTECTIVE COATINGS AREA INTO TWO PARTS AND HOLD TWO DOD/INDUSTRY WORKSHOPS. A STATUS OF OUR EFFORTS ARE GIVEN IN THE NEXT CHART.

PROTECTIVE COATINGS WORKSHOP

STATUS

- INITIAL GOVERNMENT WORKSHOP HELD
  - 9-11 OCT 1979
  - NASA LEWIS RESEARCH CENTER
  - REPRESENATIVES FROM
    - ARMY
    - NAVY
    - AIR FORCE
    - NASA
    - DOE
- FUTURE DOD/INDUSTRY MEETING

THE AD-HOC PLANNING GROUP DECIDED THAT THEIR APPROACH TO PLANNING FOR A DOD/INDUSTRY MEETING SHOULD BEGIN WITH AN EFFORT TO DETERMINE WHAT WORK WAS ALREADY UNDERWAY WITHIN THE GOVERNMENT. TO THIS END, AN INITIAL GOVERNMENT WORKSHOP WAS HELD ON 9 TO 11 OCTOBER AT THE NASA LEWIS RESEARCH CENTER. REPRESENTATIVES FROM ARMY, NAVY, AIR FORCE, NASA AND DOE DISCUSSED COATING PROJECTS BEING PURSUED IN THEIR RESPECTIVE ORGANIZATIONS. MANY SIMILARITIES WERE FOUND. FOR EXAMPLE, IN THE TURBINE AREA, COATINGS ARE BEING DEVELOPED TO SOLVE PROBLEMS FOR DIFFERENT OPERATING CONDITIONS ENCOUNTERED BY EACH SERVICE. BUT THE COMMONALITY WHICH SURFACED IS THE PROCESS USED TO APPLY THESE COATINGS. FOR EXAMPLE, PLASMA SPRAY HAS ATTRACTED A GREAT DEAL OF INTEREST AS A POTENTIAL MEANS OF ECONOMICALLY APPLYING THESE COATINGS.

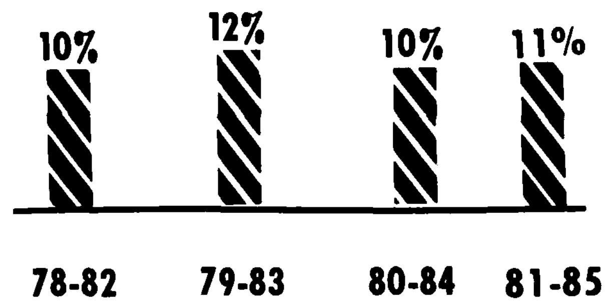
THE AD-HOC PLANNING GROUP IS NOW ANALYZING AND CONSOLIDATING THE DATA PRESENTED AT THE OCTOBER MEETING. WHEN THIS IS COMPLETED THEY WILL TURN THEIR ATTENTION TO PLANNING WHAT NOW APPEARS TO BE TWO DOD/INDUSTRY MEETINGS. THE FIRST MEETING WILL MOST LIKELY CONCERN PROPULSION SYSTEMS. THE SECOND MEETING WILL MOST LIKELY BE HELD IN THE FALL AND WILL DEAL WITH ALL OTHER COATINGS.

FORMING

FIVE YEAR FORECAST

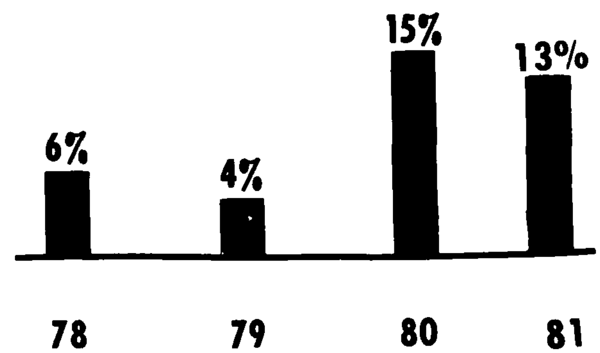
- 25-29 MILLION

COMPARISON OF FIVE YEAR PLANS



FISCAL YEARS

COMPARISON OF INDIVIDUAL YEAR PROGRAMS



FISCAL YEAR

IN THE FORMING AREA, THE FIVE YEAR FUNDING FORECAST PROJECTS AN EXPENDITURE OF BETWEEN 25-29 MILLION. THE COMPARISON OF FIVE YEAR PLANS SHOWS A CONSTANT LEVEL OF EFFORT. THE COMPARISON OF INDIVIDUAL YEAR PROGRAMS SHOWS THAT EXPENDITURES HAVE RISEN IN THE PAST TWO YEARS TO THE LEVELS PREDICTED BY THE FIVE YEAR PLANS.

FORMING

TECHNICAL OBJECTIVES

- INCREASE COMPLEX SHAPE CAPABILITY
- REDUCE NUMBER OF FORMING STEPS
- ELIMINATE SECONDARY OPERATIONS

THE TECHNICAL OBJECTIVES BEING SOUGHT IN THE FORMING AREA ARE TO INCREASE COMPLEX SHAPE CAPABILITY, REDUCE THE NUMBER OF FORMING STEPS AND TO ELIMINATE SECONDARY OPERATIONS.

FORMING

FREQUENCY	SPECIFIC PROCESS
1	COILING
1	COLD FORMING
1	DIE FORMING
1	ELECTROFORMING
1	ELECTRO-MAGNETIC
1	FORMING, CREEP
1	HEAVY DUTY DIE PRESSING
1	HEAVY DUTY LEVELING
1	HEAVY DUTY
1	STRETCHING
1	HYDROFORMING
1	PRESS CONTROL
1	PRESS STRAIGHTENING
1	PROGRESSIVE DIE FORMING
2	SHEAR SPINNING
10	SPF/DB
1	SPRING WINDING
1	STAMPING
1	STRAIGHTEN BLADES
1	SUPERPLASTIC FORMING
1	ULTRASONIC FORMING

THE SPECIFIC FORMING PROCESSES AND THE NUMBER OF PROJECTS ASSOCIATED WITH EACH PROCESS IS SHOWN ON THIS CHART.

FORMING

FY 81 PROGRAM REVIEW

- 14 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - SUPER PLASTIC FORMING/DIFFUSION BONDING

THE SUBCOMMITTEE REVIEWED 14 FY81 PROJECTS. SUPERPLASTIC FORMING/DIFFUSION BONDING WAS THE ONLY COMMON AREA IDENIIFIED.

FORMING

PROCESS	MATERIAL	APPLICATION
SUPER PLASTIC FORMING / DIFFUSION BONDING	TITANIUM	MISSILE STRUCTURES (AF)
		AIRCRAFT STRUCTURES (N) (AF) (A)

ALL THREE SERVICES ARE DOING WORK IN SUPERPLASTIC FORMING/DIFFUSION BONDING. THE NAVY AND ARMY ARE APPLYING THE RESULTS OF PRIOR AND ON-GOING WORK SPONSORED BY THE AIR FORCE. THE SUBCOMMITTEE FOUND NO DUPLICATION OF EFFORT.

FORMING

FY80 PROGRAM CHANGES REVIEW

- 5 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - NO NEW AREAS

THE SUBCOMMITTEE REVIEWED 5 NEW FY80 PROJECTS AND IDENTIFIED NO NEW COMMON AREAS.

THE FOLLOWING COMPUTER PRINTOUT LISTS ALL ACTIVE, APPORTIONMENT AND BUDGET PROJECTS THAT HAVE BEEN CLASSIFIED AS FORMING. THE PROJECTS HAVE BEEN SORTED BY THE MATERIAL BEING FORMED AND THE APPLICATION.

FORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
C701	AIR FORCE	80		MT FOR MANUFACTURING COST/DESIGN GUIDE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
C810	AIR FORCE	80		MT FOR SHEET METAL CELL DEMONSTRATIONS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01C809	AIR FORCE	80		MT FOR OPTIMAL SHEET METAL MACHINE DESIGNS AND TRANSITION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01C805	AIR FORCE	80		MT FOR OPTIMAL SHEET METAL CENTER DESIGN

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	

FORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91C701	AIR FORCE	80		MT FOR UNIFIED SHEET METAL MODEL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
98M126	AIR FORCE	80 79	NU	MT FOR LOW COST 20MM CARTRIDE CASES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	20MM CARTRIDGE CASE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
E 3761	ARMY	79		DIMPLE PLATE WEB FOR BRIDGES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	SUPPORT EQUIPMENT	BRIDGE STRUCTURAL MEMBERS	STAMPING SPOT WELDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00641	NAVY	81		PROPELLOR BLADE STRAIGHTENING MACHINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
BRONZE	SHIPS	PROPELLORS	STRAIGHTEN BLADES

```
***
                          YEARS OF
   EFFORT NO   SERVICE    FUNDING    STATUS   TITLE
***
*  01M219      AIR FORCE     80               MT FOR STATIC ALUMINIDE COMPONENTS PROCESSING
*                            81

                MATERIAL          APPLICATION        COMPONENT                   SPECIFIC PROCESS
***
*               OTHER             AIRCRAFT           TURBINE ENGINES
*                                                    BLADES TURBINE
------------------------------------------------------------------------------------------------

                          YEARS OF
   EFFORT NO   SERVICE    FUNDING    STATUS   TITLE
***
*  5 6634      ARMY          79               MFG DU ALLOYS FOR LARGE CALIBER ARMOR DEFEATING PROJECTILE
*                            78
*                            77
*                            76

                MATERIAL          APPLICATION        COMPONENT                   SPECIFIC PROCESS
***
*               OTHER             AMMUNITION         METAL PARTS                 CASTING
*                                                                                ROLLING
*                                                                                MACHINING
*                                                    PROJECTILES
------------------------------------------------------------------------------------------------

                          YEARS OF
   EFFORT NO   SERVICE    FUNDING    STATUS   TITLE
***
*  DNS00564    NAVY          81               HEAT EXCHANGER FABRICATION

                MATERIAL          APPLICATION        COMPONENT                   SPECIFIC PROCESS
***
*               STEEL             AMMUNITION         HEAT EXCHANGER, TORPEDO     ELECTROFORMING
------------------------------------------------------------------------------------------------

                          YEARS OF
   EFFORT NO   SERVICE    FUNDING    STATUS   TITLE
***
*  DNS00547    NAVY          81               WARHEAD COMPONENT FABRICATION

                MATERIAL          APPLICATION        COMPONENT                   SPECIFIC PROCESS
***
*               STEEL             AMMUNITION         WARHEAD, TORPEDO            HYDROFORMING
*                                                    LINER
------------------------------------------------------------------------------------------------
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EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
91C701	AIR FORCE	80		MT FOR UNIFIED SHEET METAL MODEL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AIRCRAFT	AIRFRAMES	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
98M126	AIR FORCE	80 79	NU	MT FOR LOW COST 20MM CARTRIDE CASES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	20MM CARTRIDGE CASE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
E 3761	ARMY	79		DIMPLE PLATE WEB FOR BRIDGES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	SUPPORT EQUIPMENT	BRIDGE STRUCTURAL MEMBERS	STAMPING SPOT WELDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00641	NAVY	81		PROPELLOR BLADE STRAIGHTENING MACHINE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
BRONZE	SHIPS	PROPELLORS	STRAIGHTEN BLADES

FORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M219	AIR FORCE	80 81		MT FOR STATIC ALUMINIDE COMPONENTS PROCESSING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AIRCRAFT	TURBINE ENGINES BLADES TURBINE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
5 6634	ARMY	79 78 77 76		MFG DU ALLOYS FOR LARGE CALIBER ARMOR DEFEATING PROJECTILE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	AMMUNITION	METAL PARTS PROJECTILES	CASTING ROLLING MACHINING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00564	NAVY	81		HEAT EXCHANGER FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	HEAT EXCHANGER, TORPEDO	ELECTROFORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00547	NAVY	81		WARHEAD COMPONENT FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	WARHEAD, TORPEDO LINER	HYDROFORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
S 1001	ARMY	81 80		PILOT LINE FOR FUZE FLUIDIC POWER SUPPLIES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AMMUNITION	FUZES	PROGRESSIVE DIE FORMING ASSEMBLY

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5068	ARMY	80 81		NEW ANTI-CORROSIVE MATERIALS AND TECHNIQUES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	SHEET METAL COMPONENTS BODY	DIE FORMING SPOT WELDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 6023	ARMY	78		FABRICATION OF FLAT THIN GAGE ALLOY STEEL PLATE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	ARMOR	HEAVY DUTY LEVELING HEAVY DUTY DIE PRESSING HEAVY DUTY STRETCHING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
H 3294	ARMY	80 81		PRODUCTION PROCESSES FOR ROTARY ROLL FORMING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	MISSILES	ROCKET MOTOR	ROTARY ROLL FORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00410	NAVY	79		MAGNETIC FORMING OF BOILER TUBES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	BOILERS	ELECTRO-MAGNETIC

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00572	NAVY	81		ADJUSTABLE POST MOCK SYSTEM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	HULL STRUCTURE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 3901	ARMY	80 78		MANUFACTURE OF FLUIDIC AMPLIFIERS BY COLD FORMING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	GUN STABILIZATION SYSTEM FLUIDIC CONTROL SYSTEMS	COLD FORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7087	ARMY	73		APPLICATION OF HIGH FREQUENCY INDUCTION HEATING FOR HOT COIL SPRINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	LARGE CALIBER RECOIL SPRINGS	INDUCTION HEATING SPRING WINDING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 7720	ARMY	77		FABRICATION METHODS FOR 2 AND 3 WIRE MECHANICAL SPRINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	SMALL CALIBER SPRINGS	COILING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8045	ARMY	78		IMPROVED TUBE STRAIGHTENING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	CANNON TUBES	PRESS STRAIGHTENING PRESS CONTROL

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M201	AIR FORCE	83 82 81		MT FOR EXPLOSIVE FABRICATION OF ENGINE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES SHROUDS STIFFENERS EXPLOSIVE FORMING	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA81026	NAVY	79		SPF/DB OF TITANIUM GLOVE VANE

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRFRAME STRUCTURAL MEMBERS	SPF/DB

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
01M242	AIR FORCE	80	NU	MT FOR APPLICATION OF SPF/DB TITANIUM FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	SPF/DB T38 MAIN LANDING GEAR	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
11M220	AIR FORCE	81		TITANIUM COMPONENTS FOR SERVICE EVALUATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	T38 HORIZ STABILIZER	SPF/DB

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7284	ARMY	78 79		SUPERPLASTIC FORMING - DIFFUSION BONDING OF TITANIUM

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	FIREWALL	SUPERPLASTIC FORMING BONDING, DIFFUSION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
1 7052	ARMY	80 75 77		ULTRASONICALLY-ASSISTED COLD FORMING OF TITANIUM NOSE CAPS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	ROTOR BLADES NOSE CAPS	ULTRASONIC FORMING

FORMING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
51M875	AIR FORCE	75 76		MT FOR LOW COST NONROTATING TITANIUM ENGINE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	TURBINE ENGINES COMPRESSOR CASES	FORMING, CREEP BONDING, DIFFUSION

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M163	AIR FORCE	78 77	NU	MT FOR APPLICATION OF SPF/DB TITANIUM FABRICATION

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	DOOR STRUT MLG	SPF/DB

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
71M862	AIR FORCE	78 77		MT FOR SPF/DB LIMITS OF THE MANUFACTURING PROCESS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	AIRFRAME STRUCTURES	SPF/DB

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
81M110	AIR FORCE	80 78	NU	MT FOR MANUFACTURING SCALE-UP OF COLD FORMABLE TI SHEET

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
TITANIUM	AIRCRAFT	STRUCTURES	

FORMING

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***
                                  YEARS OF
     EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*    81M255       AIR FORCE         78                  MT FOR APPLICATION OF SPF/DB TITANIUM FABRICATION
                   MATERIAL             APPLICATION          COMPONENT                    SPECIFIC PROCESS
***
*                  TITANIUM             AIRCRAFT             AIRFRAME STRUCTURES          SPF/DB
-----------------------------------------------------------------------------

                                  YEARS OF
     EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*    81M256       AIR FORCE         78                  MT FOR MULTIPLE SHEET ASSEMBLY BY SPF/DB
                   MATERIAL             APPLICATION          COMPONENT                    SPECIFIC PROCESS
***
*                  TITANIUM             AIRCRAFT             AIRFRAME STRUCTURES          SPF/DB
*                                                            HORIZONTAL TAIL SURFACES
-----------------------------------------------------------------------------

                                  YEARS OF
     EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*    91M204       AIR FORCE         80                  MT FOR INNOVATIVE LOW COST TOOLING
*                                   79
*                                   81
                   MATERIAL             APPLICATION          COMPONENT                    SPECIFIC PROCESS
***
*                  TITANIUM             AIRCRAFT             AIRFRAME                     SPF/DB
*                                                            TURBINE ENGINES
-----------------------------------------------------------------------------

                                  YEARS OF
     EFFORT NO    SERVICE         FUNDING     STATUS    TITLE
***
*    DNS00644     NAVY              79                  ISOTHERMAL FORMING OF TRANSAGE TITANIUM
                   MATERIAL             APPLICATION          COMPONENT                    SPECIFIC PROCESS
***
*                  TITANIUM             MISSILES             PRESSURE VESSEL              SHEAR SPINNING
-----------------------------------------------------------------------------
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***
                            YEARS OF
   EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*  02M237      AIR FORCE      80                MT FOR TI MX SHROUD

                MATERIAL          APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*               TITANIUM          MISSILES            SHROUD                     SPF=DB
*                                                     PANELS SANDWICH
------------------------------------------------------------------

                            YEARS OF
   EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*  02M285      AIR FORCE      81         NU     MT FOR SPFDB TI COMPONENTS FOR SMALL ENGINES
*                             82
*                             80

                MATERIAL          APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*               TITANIUM          MISSILES            TURBINE ENGINES
*                                                     COMBUSTOR
*                                                     CASE
------------------------------------------------------------------

                            YEARS OF
   EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*  12M223      AIR FORCE      81                MT FOR LOW COST ADVANCED TITANIUM BODY STRUCTURES
*                             82

                MATERIAL          APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*               TITANIUM          MISSILES            STRUCTURES                 SPF/DB END
*                                                     WING COVERS/BEAMS
------------------------------------------------------------------

                            YEARS OF
   EFFORT NO   SERVICE      FUNDING    STATUS   TITLE
***
*  12M224      AIR FORCE      81                MT FOR LOW COST TITANIUM PROPELLANT TANK

                MATERIAL          APPLICATION         COMPONENT                  SPECIFIC PROCESS
***
*               TITANIUM          MISSILES            TANK,PROPELLANT            SPF/DB
*                                                                                SHEAR SPINNING
------------------------------------------------------------------
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FORMING

FUTURE SUBCOMMITTEE ACTIVITY

- INVESTIGATE POSSIBILITY OF JOINT NAVY/AIR FORCE PROGRAM TO DEFINE THE LIMITS OF SUPER PLASTIC FORMING/DIFFUSION BONDING

DURING THE PROJECT REVIEW, THE NAVY EXPRESSED INTEREST IN THE POSSIBILITY OF JOINING THE AIR FORCE IN THEIR PROGRAM TO DEFINE THE LIMITS OF SUPERPLASTIC FORMING/DIFFUSION BONDING.

OTHER

FREQUENCY	SPECIFIC PROCESS
1	HOT ISOSTATIC PRESSING
4	HOT PRESSING
2	LOOSENING FASTENERS
2	MATERIAL HANDLING
1	PRESSURE TESTING
1	RARE EARTH ADDITIONS
2	REACTION BONDING
1	REMANUFACTURE
1	SINTERING
1	SLIP CASTING

THE "OTHER PROCESSES" AREA CONSISTS OF THE SPECIFIC PROCESSES SHOWN HERE. THE NUMBER OF PROJECTS DEALING WITH EACH PROCESS IS ALSO SHOWN. THESE PROCESSES PRIMARILY FALL INTO THE CATEGORIES OF CERAMIC PROCESSING AND SPECIFIC PROCESSES FOR REPAIR.

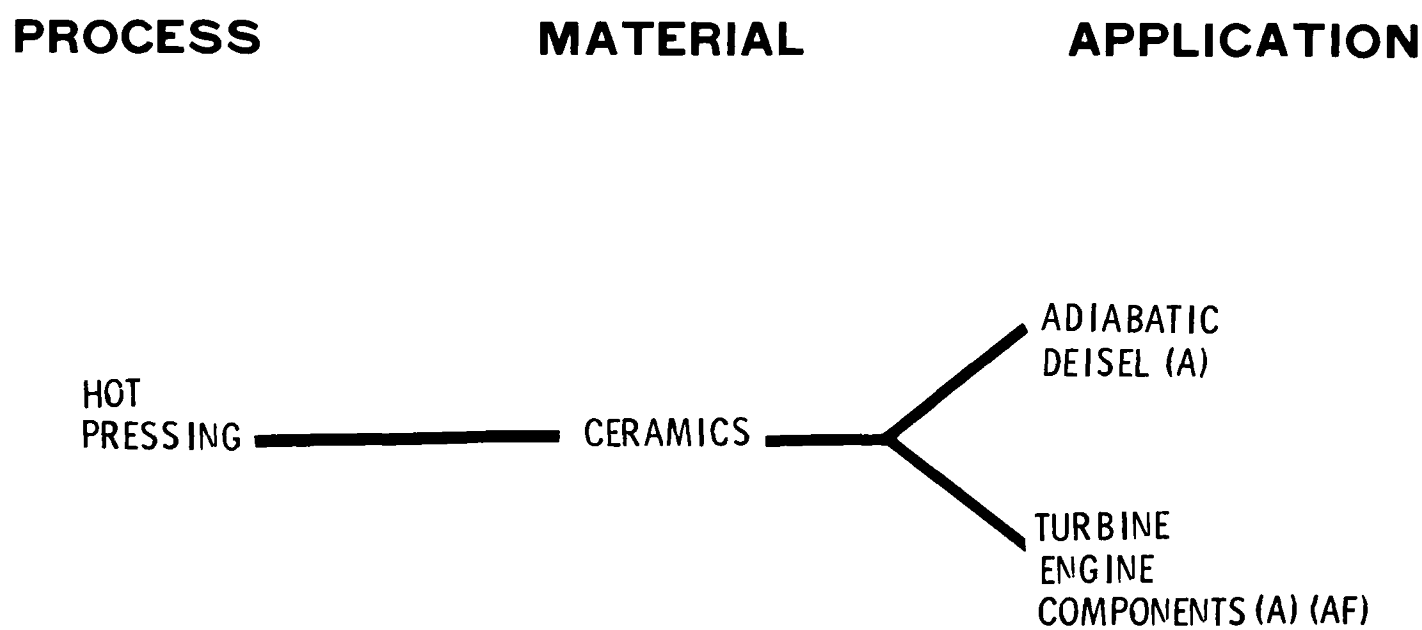
OTHER METAL PROCESSES

FY 81 PROGRAM REVIEW

- 4 PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
  - HOT PRESSING

THE SUBCOMMITTEE REVIEWED 4 FY81 PROJECTS AND IDENTIFIED HOT PRESSING AS A COMMON AREA.

OTHER METAL PROCESSES



WHILE THE ARMY AND AIR FORCE ARE WORKING ON HOT PRESSING CERAMICS, THE SUBCOMMITTEE DETERMINED THAT THE PROPERTIES REQUIRED FOR THE VARIOUS APPLICATIONS BEING PURSUED IN EACH PROJECT WERE DIFFERENT AND WOULD REQUIRE DIFFERENT PROCESSING PROCEDURES. THEREFORE, NO DUPLICATION EXISTS.

OTHER METAL PROCESSES

FY 80 PROGRAM CHANGES REVIEW

- 2 NEW PROJECTS REVIEWED
- COMMON AREAS IDENTIFIED
- NO NEW AREAS

THE SUBCOMMITTEE REVIEWED 2 NEW FY80 PROJECTS AND FOUND NO NEW COMMON AREAS THAT HAD NOT ALREADY BEEN IDENTIFIED IN THE REVIEW OF FY81 PROJECTS.

THE FOLLOWING COMPUTER PRINTOUT LISTS ALL ACTIVE, APPORTIONMENT AND BUDGET PROJECTS THAT HAVE BEEN CLASSIFIED AS OTHER PROCESSES. THEY HAVE BEEN SORTED BY THE MATERIAL BEING PROCESSED AND ITS APPLICATION.

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
98M181	AIR FORCE	80	NU	MT FOR LOW COST 20MM AL CARTRIDGE CASE TESTING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
ALUMINUM	AMMUNITION	20MM CARTRIDGE CASE	

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
72M358	AIR FORCE	77 78		MT FOR CERAMIC ENGINE BEARINGS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
CERAMIC	MISSILES	TURBINE ENGINES BEARINGS	HOT PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5053	ARMY	81 82 83		FABRICATION TECHNIQUES FOR HIGH STRENGTH CERAMICS FOR DIESEL ENGINES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
CERAMICS	LAND VEHICLES	ADIUBATIC DIESEL ENGINES PISTON CAP HEAD LINER CYLINDER WALL LINER EXHAUST PORTS VALVES	HOT PRESSING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
72M730	AIR FORCE	81 78 77 79		MT FOR CERAMIC ENGINE COMPONENTS

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
CERAMICS	MISSILES	VANES	SLIP CASTING REACTION BONDING HOT PRESSING
		BLADES TURBINE ENGINES	

OTHER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
E 3717	ARMY	78 80 81		HIGH TEMPERATURE TURBINE NOZZLE FOR 10 KW POWER UNIT

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
CERAMICS	SUPPORT EQUIPMENT	TURBINE ENGINES NOZZLE GENERATOR	HOT PRESSING REACTION BONDING SINTERING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00651	NAVY	80		MATERIAL HANDLING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
OTHER	SHIPS	ONBOARD MATERIAL	MATERIAL HANDLING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNA00703	NAVY	80	NU	CRITICAL AIRCRAFT BEARING REFURBISHMENT

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	AIRCRAFT SHIPS AIRCRAFT	AIRFRAME BEARINGS TURBINE ENGINES BEARINGS	REMANUFACTURE

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
T 5094	ARMY	79		ALLOY AND ARMOR STEELS TREATED WITH RARE EARTH ADDITIVES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	LAND VEHICLES	ARMOR	RARE EARTH ADDITIONS

OTHER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00649	NAVY	81		ULTRASONIC WRENCH DEVELOPMENT

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	METAL FASTENERS	LOOSENING FASTENERS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00646	NAVY	80		HYDRAULIC SYSTEM OVERHAUL

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	SHIPS	SUBMARINES HYDRAULIC SYSTEMS	PRESSURE TESTING

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
DNS00359	NAVY	79		ULTRASONIC WRENCH DEVELOPMENT

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCFSS
STEEL	SHIPS	METAL FASTENERS	LOSENING FASTENERS

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
6 8208	ARMY	80		MATERIAL HANDLING

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
STEEL	WEAPONS	BARRELS, CANNON	MATERIAL HANDLING

OTHER

EFFORT NO	SERVICE	YEARS OF FUNDING	STATUS	TITLE
TIM232	AIR FORCE	76 77		MT FOR HIP REJUVENATION OF CREEP-DAMAGED TURBINE BLADES

MATERIAL	APPLICATION	COMPONENT	SPECIFIC PROCESS
SUPERALLOY	AIRCRAFT	TURBINE ENGINES BLADES	HOT ISOSTATIC PRESSING

OTHER METAL PROCESSES

SUBCOMMITTEE ACCOMPLISHMENTS

- ESTABLISHED GAS TURBINE ENGINE MANUFACTURING TECHNOLOGY WORKING GROUP
- SPONSORED BEARING MANUFACTURING TECHNOLOGY WORKSHOP
- SPONSORED TRI-SERVICE METALS MANUFACTURING TECHNOLOGY STATUS REVIEW

FUTURE SUBCOMMITTEE ACTIVITIES

- SPONSOR MINI-SYMPOSIUM AT THE 1980 ANNUAL MTAG MEETING

THE SUBCOMMITTEE ESTABLISHED THE GAS TURBINE ENGINE MANUFACTURING TECHNOLOGY WORKING GROUP, AND HELD A DOD/INDUSTRY BEARING WORKSHOP AND THE TRI-SERVICE METALS MANUFACTURING TECHNOLOGY PROGRAM STATUS REVIEW. THESE WILL BE ADDRESSED IN MORE DETAIL IN THE FOLLOWING CHARTS.

THE SUBCOMMITTEE WILL PLAN AND EXECUTE THE METALS MINI-SYMPOSIUM AT THE 1980 MTAG ANNUAL MEETING.

GAS TURBINE ENGINE WORKING GROUP

FUNCTION

- RECOMMEND COURSES OF ACTION TO
  - ESTABLISH MULTI-SERVICE PROGRAMS
  - FILL MANUFACTURING TECHNOLOGY GAPS
  - DISSEMINATE MANUFACTURING TECHNOLOGY INFORMATION

THE FUNCTION OF THE GAS TURBINE ENGINE MANUFACTURING TECHNOLOGY WORKING GROUP IS TO RECOMMEND COURSES OF ACTION TO:

A. ESTABLISH MULTI-SERVICE PROGRAMS

B. FILL THE GAPS IN THE THREE SERVICES MANUFACTURING TECHNOLOGY PLANS FOR TURBINE ENGINES

C. AND DISSEMINATE MANUFACTURING TECHNOLOGY DATA FOR ON-GOING AND COMPLETED EFFORTS.

THIS GROUP WAS FORMALLY ESTABLISHED IN MAY OF THIS YEAR. MR. HENRY JOHNSON, CHIEF OF THE METALS BRANCH, AIR FORCE MATERIALS LABORATORY HAS BEEN APPOINTED ITS CHAIRMAN. THE ARMY, NAVY, AND AIR FORCE HAVE DESIGNATED INDIVIDUALS FOR MEMBERSHIP. AND AS A RESULT OF THE METALS SUBCOMMITTEE MEETING THIS SUMMER, SOME INITIAL TASKS HAVE BEEN ASSIGNED.

INFORMALLY, THE GROUP HAD ALREADY TAKEN ACTIONS. BESIDES ESTABLISHING THE TURBINE ENGINE RELATED JOINT PROGRAMS ALREADY DISCUSSED IN THIS REPORT, THEY WERE ALSO RESPONSIBLE FOR FORMING JOINT EFFORTS FOR COMPOSITE SHAFTS AND FOR INTEGRATED BLADE INSPECTION SYSTEM.

BEARING TECHNOLOGY WORKSHOP

- 31 JULY-2 AUGUST, SCOTTSDALE, AZ
- 100 ATTENDEES
- SPONSORED BY MTAG AND DOD BEARING COMMITTEES

AD-A085 756 ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY ROCK ISLAND IL F/G 11/6
METALS SUBCOMMITTEE REPORT - MANUFACTURING TECHNOLOGY ADVISORY --ETC(U)
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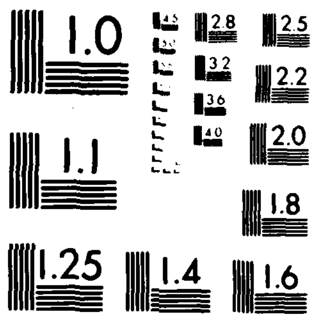

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

THE BEARING MANUFACTURING TECHNOLOGY WORKSHOP WAS HELD IN SCOTTSDALE, ARIZONA 31 JULY TO 2 AUGUST. ONE HUNDRED PEOPLE WERE IN ATTENDANCE. IT WAS SPONSORED BY NOT ONLY THE METALS SUBCOMMITTEE BUT ALSO THE TEST AND INSPECTION SUBCOMMITTEE AND THE THREE DOD BEARING COMMITTEES. ONE OF OUR OBJECTIVES IN UNDERTAKING THIS WORKSHOP WAS TO EXPAND THE CONCERNS OF THE DOD BEARING COMMITTEES TO INCLUDE MANUFACTURING TECHNOLOGY. THE DOD BEARING COMMITTEES WORKED VERY HARD IN PREPARATION AND EXECUTION OF THE WORKSHOP AND THEY DESERVE THE LION'S SHARE OF THE CREDIT FOR ITS SUCCESS.

BEARING TECHNOLOGY WORKSHOP

MAJOR CONCLUSIONS

- SIGNIFICANT DOD PROBLEMS EXIST IN PACKAGING AND LUBRICATION
- IMPROVED MANUFACTURING TECHNOLOGY FOR QUIET BEARINGS IS REQUIRED
- NEED FOR IMPROVED NONDESTRUCTIVE INSPECTION TECHNIQUES
- THE RELATIONSHIP BETWEEN SURFACE CONDITION AND BEARING LIFE NOT WELL UNDERSTOOD

THIS CHART SHOWS SOME OF THE MAJOR CONCLUSIONS REACHED AT THE WORKSHOP. MUCH DISCUSSION WAS GENERATED CONCERNING PACKAGING AND LUBRICATION. IT BECAME EVIDENT THAT THESE TOPICS NEEDED TO BE COVERED IN MORE DETAIL. THEREFORE, CONTINUED DIALOGUE WITH INDUSTRY WAS RECOMMENDED IN THE FORM OF ADDITIONAL WORKSHOPS AIMED SPECIFICALLY AT THESE TOPICS.

ONE OF THE MOST EMOTIONAL TOPICS DISCUSSED WAS THE PROCUREMENT FROM FOREIGN SOURCES OF QUIET BEARINGS FOR SHIPS AND SUBMARINES. IT WAS UNANIMOUSLY CONCLUDED THAT DOD SHOULD FUND AN MT EFFORT TO IMPROVE THE MANUFACTURING TECHNOLOGY FOR THESE BEARINGS.

THE NEED FOR IMPROVED NON DESTRUCTIVE INSPECTION TECHNIQUES WAS HIGHLIGHTED AT THIS WORKSHOP AS IT HAS BEEN AT ALL OUR WORKSHOPS. THE NEED COVERS THE RANGE OF MATERIAL, DIMENSIONAL AND FUNCTIONAL INSPECTION.

ANOTHER ISSUE WHICH WAS CONTINUALLY RAISED DURING THE WORKSHOP DEALT WITH THE RELATIONSHIP BETWEEN SURFACE CONDITION AND BEARING LIFE. BY SURFACE CONDITION, I MEAN SEVERAL THINGS. FIRST, THERE IS THE SURFACE CHEMISTRY THAT TAKES PLACE BETWEEN THE METAL AND VARIOUS CHEMICALS THAT ARE BROUGHT INTO CONTACT WITH IT DURING ITS MANUFACTURING AND ITS OPERATION. SECOND, THERE IS SURFACE TEXTURE, A COMBINATION OF SURFACE FINISH, CURVATURE AND WAVENESS. AND THIRD, THERE IS NEAR SURFACE CONDITION SUCH AS MATERIAL DEFECTS AND RESIDUAL STRESS. IF WE KNEW MORE QUANTITATIVELY THE EFFECTS OF THESE VARIABLES UPON BEARING PERFORMANCE AND LIFE, IMPROVEMENTS IN MANUFACTURING TECHNOLOGY COULD BE MORE RATIONALLY SOUGHT.

TRI-SERVICE METALS MANUFACTURING TECHNOLOGY STATUS REVIEW

PLACE: DAYTONA BEACH, FLORIDA

TIME: 25-27 SEPTEMBER 79

NUMBER OF ATTENDEES: 175

THRUST: NET SHAPE PROCESSES

NUMBER OF PAPERS GIVEN: 31

WE SPONSORED OUR FIRST DOD/INDUSTRY TECHNOLOGY TRANSFER SEMINAR IN LATE SEPTEMBER IN DAYTONA BEACH. 175 ATTENDED THE SEMINAR WHERE 31 PAPERS WERE PRESENTED COVERING THE LATEST ADVANCES IN NET SHAPE PROCESSES. THIS DOD SPONSORED WORK COVERED MOLTEN METAL SOLIDIFICATION PROCESSES, POWDER METAL CONSOLITATION PROCESS AND WROUGHT METAL DEFORMATION PROCESSES. A DAY WAS DEVOTED TO EACH TYPE OF PROCESS AND THE PAPERS FROM EACH DAY WERE PUBLISHED IN SEPARATE BOOKS. THESE BOOKS WILL BE AVAILABLE FROM THE DEFENSE DOCUMENTATION CENTER IN THE NEAR FUTURE.

THE FEED BACK RECEIVED THUS FAR INDICATES THAT THIS MEETING WAS VERY SUCCESSFUL. IN FACT, SEVERAL PEOPLE HAVE SAID THAT IS WAS THE BEST MEETING THAT THEY HAVE EVER ATTENDED.

METALS SUBCOMMITTEE ACTIVITIES

- PROJECT REVIEW
- PROGRAM DATA ANALYSIS
- DOD/INDUSTRY DIALOGUE

IN ORDER TO MEASURE THE EFFECTIVENESS OF THE SUBCOMMITTEE, ONE MUST EXAMINE OUR ACTIVITIES AND DETERMINE WHAT ACTIONS HAVE BEEN TAKEN AS A RESULT OF THEM. WE BREAK OUR ACTIVITIES INTO THE THREE TYPES SHOWN HERE. ALL THREE TYPES ARE BASED UPON EXCHANGING INFORMATION WHICH LEADS TO IMPROVEMENTS IN THE SERVICES PROGRAMS AND BETTER UTILIZATION OF DOD'S FUNDS. THE DIFFERENCE AMONG THEM IS THE TYPE OF INFORMATION EXCHANGED AND THE FORUM AT WHICH IT IS EXCHANGED. THE INDIVIDUAL PROJECT REVIEW IS PERFORMED BY THE SUBCOMMITTEE MEMBERS FOR THE ELIMINATION OF POTENTIAL DUPLICATION OF EFFORT. PROGRAM DATA AND ANALYSIS IS PRESENTED AT THE ANNUAL MTAG MEETING TO CREATE DISCUSSION ABOUT THE TRENDS OCCURRING IN THE SERVICE'S PROGRAMS. THE DIALOGUE BETWEEN DOD AND INDUSTRY IS UNDERTAKEN TO EXCHANGE INFORMATION ON MANUFACTURING TECHNOLOGY ACCOMPLISHMENTS AND FUTURE DIRECTIONS OF THE PROGRAM.

PROJECT REVIEW

ACTIONS TAKEN

CALENDAR YEAR

	75	76	77	78	79	80
EFFORTS DELETED OR DEFERRED	2	2	2			
EFFORTS FOR JOINT FUNDING		1	1	5	7	13

ONE MEASURE OF EFFECTIVENESS FOR OUR PROJECT REVIEW ACTIVITIES IS TO EXAMINE HOW MANY EFFORTS HAVE BEEN DELETED OR DEFERRED, OR HOW MANY HAVE RESULTED IN AGREEMENT AMONG THE SERVICES FOR JOINT FUNDING. IN THE BEGINNING, THE PREFERRED ACTION WAS TO DELETE OR DEFER EFFORTS. HOWEVER, MORE RECENTLY, THE SERVICES HAVE RECOGNIZED THE ADVANTAGES OF WORKING TOGETHER WHICH HAS LED TO THE PREFERRED ACTION OF FORMING MULTI-SERVICE EFFORTS.

PROGRAM DATA AND ANALYSIS

ACTIONS TAKEN

- MORE DIFFICULT TO ASSESS
  - CHIP CUTTING CONFERENCE
  - DETERMINING FUTURE SUBCOMMITTEE ACTIVITIES
- IMPROVEMENTS TO BE SOUGHT
  - EXECUTIVE COMMITTEE
  - INDUSTRIAL ASSOCIATIONS AND TECHNICAL SOCIETIES

ONE MEASURE OF EFFECTIVENESS FOR OUR PROJECT REVIEW ACTIVITIES IS TO EXAMINE HOW MANY EFFORTS HAVE BEEN DELETED OR DEFERRED, OR HOW MANY HAVE RESULTED IN AGREEMENT AMONG THE SERVICES FOR JOINT FUNDING. IN THE BEGINNING, THE PREFERRED ACTION WAS TO DELETE OR DEFER EFFORTS. HOWEVER, MORE RECENTLY, THE SERVICES HAVE RECOGNIZED THE ADVANTAGES OF WORKING TOGETHER WHICH HAS LED TO THE PREFERRED ACTION OF FORMING MULTI-SERVICE EFFORTS.

PROGRAM DATA AND ANALYSIS

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- MORE DIFFICULT TO ASSESS
  - CHIP CUTTING CONFERENCE
  - DETERMINING FUTURE SUBCOMMITTEE ACTIVITIES
- IMPROVEMENTS TO BE SOUGHT
  - EXECUTIVE COMMITTEE
  - INDUSTRIAL ASSOCIATIONS AND TECHNICAL SOCIETIES

IT IS DIFFICULT TO PINPOINT THE PROGRAM CHANGES THAT HAVE RESULTED FROM PROVIDING THE TYPE OF DATA AND ANALYSIS CONTAINED IN THIS REPORT. HOWEVER, THERE ARE EXAMPLES OF HOW THIS DATA HAS BEEN USED. FOR EXAMPLE, THE DATA WE PROVIDED AT THE 1976 MTAG ANNUAL MEETING RE-ENFORCED DOD'S CONCERN THAT INSUFFICIENT EMPHASIS WAS BEING PLACED ON TRADITIONAL METAL REMOVAL PROCESSES. THIS CONCERN LED TO THE DOD/INDUSTRY CHIP CUTTING CONFERENCE, WHICH IN TURN WAS AT LEAST PARTLY RESPONSIBLE FOR THE MAJOR THRUST WHICH IS CURRENTLY EVIDENT IN METAL REMOVAL. IN ANOTHER EXAMPLE, WE, IN THE SUBCOMMITTEE, HAVE USED THIS DATA FOR GUIDING OUR OWN FUTURE ACTIONS SUCH AS SELECTING IMPORTANT TECHNOLOGY AREAS FOR OUR WORKSHOPS. HOWEVER, WE BELIEVE THAT IMPROVEMENTS CAN BE MADE. WE ARE NOT SURE THAT WE ARE PROVIDING THE RIGHT INFORMATION TO THE RIGHT PEOPLE IN A USEABLE FORMAT. THIS YEAR, WE PLAN TO ATTACK THIS PROBLEM BY CONSULTING WITH THE EXECUTIVE COMMITTEE AND WITH THE INDUSTRIAL ASSOCIATIONS AND TECHNICAL SOCIETIES TO DETERMINE WHAT IMPROVEMENTS SHOULD BE MADE.

DOD/INDUSTRY DIALOGUE

ACTIONS TAKEN

CALENDAR YEAR

	75	76	77	78	79	80
TECHNOLOGY ASSESSMENT WORKSHOPS			1	2	1	3
TECHNOLOGY TRANSFER SEMINAR					2	1

THE DOD/INDUSTRY DIALOGUE BEGAN WITH INDUSTRY, THROUGH THE INDUSTRIAL ASSOCIATIONS AND TECHNICAL SOCIETIES, ATTENDING THE ANNUAL MTAG MEETING IN 1974, THE SAME YEAR THE SUBCOMMITTEES WERE ESTABLISHED. AS A RESULT OF THAT MEETING AND OTHERS, THESE ASSOCIATIONS AND TECHNICAL SOCIETIES AGREED TO REVIEW AND COMMENT ON THE SERVICES BUDGET PROGRAMS AND FIVE YEAR PLANS. IN THE METALS AREA, THE ASSOCIATIONS AND SOCIETIES FOUND IT DIFFICULT TO ADEQUATELY REVIEW THE PROJECTS DUE TO THE SHORTNESS OF TIME, THE NUMBER OF PROJECTS, AND DIVERSITY OF PROCESSES AND APPLICATIONS TO BE REVIEWED. THE SUBCOMMITTEE ALSO FOUND IT DIFFICULT TO RESPOND TO THE COMMENTS THAT WERE MADE. AN ALTERNATE VEHICLE HAD TO BE FOUND THAT WOULD ALLOW INDUSTRIAL INPUT INTO DOD'S PLANS. THE SUBCOMMITTEE CHOSE TO EMBELLISH UPON THE AIR FORCE'S CONCEPT OF HOLDING TECHNOLOGY ASSESSMENT WORKSHOPS. THESE WORKSHOPS ALLOW US TO BREAK THE METALS AREA INTO SMALLER, MORE DIGESTABLE SUBJECTS AND TO SEEK THE ADVICE OF A LARGER NUMBER OF INDUSTRIAL, ACADEMIC, AND GOVERNMENT EXPERTS. THE SUBCOMMITTEE HAS SPONSORED FOUR WORKSHOPS THUS FAR AND HAS THREE MORE IN THE PLANNING PHASE.

ANOTHER TYPE OF DOD/INDUSTRY DIALOGUE BEGUN BY THE SUBCOMMITTEE THIS YEAR, INVOLVES TECHNOLOGY TRANSFER SEMINARS. WE HAVE HELD TWO SUCH SEMINARS THIS YEAR AND WILL HOLD ONE NEXT YEAR.

SUMMARY

ACCOMPLISHMENTS

- 14 JOINT PROGRAMS ESTABLISHED
- 6 WORKSHOPS AND SEMINARS HELD

IN SUMMARY, THE SUBCOMMITTEE HAS IN THE PAST FIVE YEARS, ESTABLISHED 14 JOINT PROGRAMS AND SPONSORED 6 WORKSHOPS AND SEMINARS.

SUMMARY

FUTURE ACTIVITIES

- 13 POTENTIAL JOINT EFFORTS
- 4 WORKSHOPS AND SEMINARS
- IMPROVE METALS SUBCOMMITTEE REPORT

IN THE NEXT YEAR, THE SUBCOMMITTEE WILL INVESTIGATE THE POSSIBILITY OF ESTABLISHING 13 JOINT EFFORTS, HOLDING 4 WORKSHOPS AND SEMINARS AND WILL ATTEMPT TO IMPROVE THE METALS SUBCOMMITTEE REPORT.

CONCLUSIONS

- METALS SUBCOMMITTEE HAS STEADILY GROWN BY UNDERTAKING MORE ACTIVITIES IN MEETING ITS RESPONSIBILITIES
- THE LIMIT OF THE RESOURCES WHICH CAN BE REASONABLY EXPECTED TO BE PROVIDED IS BEING APPROACHED
- CAREFUL CONSIDERATION WILL HAVE TO BE GIVEN TO ANY FUTURE EXPANSION OF OUR ACTIVITIES

AS EVIDENCED BY THE PRECEEDING CHARTS, THE METALS SUBCOMMITTEE HAS BEEN VERY ACTIVE DURING THE PAST FIVE YEARS. THERE HAS BEEN STEADY GROWTH IN THE NUMBER AND KINDS OF ACTIVITY WE HAVE UNDERTAKEN IN MEETING OUR RESPONSIBILITIES. MORE IMPORTANTLY, THESE ACTIVITIES HAVE PROVEN TO BE EFFECTIVE AND HAVE HAD A SIGNIFICANT IMPACT UPON DOD'S METALS MANUFACTURING TECHNOLOGY PROGRAM. HOWEVER, THERE ARE SIGNS WHICH ARE BEGINNING TO APPEAR THAT INDICATE WE ARE APPROACHING THE LIMIT OF THE RESOURCES WHICH CAN REASONABLY BE EXPECTED TO BE PROVIDED BY THE SERVICES. THE SUBCOMMITTEE HAS NO BUDGET OF ITS OWN; AND, THEREFORE MUST RELY ON THE SERVICES FOR MEETING TRAVEL AND PRINTING EXPENSES. TRAVEL FUNDS, IN PARTICULAR, HAVE BECOME MORE SCARCE DURING THE PAST COUPLE OF YEARS. BUT THE GREATEST CONCERN OF THE RESOURCE PROBLEM IS THE AVAILABLE MANHOURS TO ACCOMPLISH THESE ACTIVITIES. THESE MANHOUR REQUIREMENTS, WHICH ARE PROVIDED BY THE SERVICES, AT TIMES COMPETE WITH THEIR MISSION RESPONSIBILITIES. AT A TIME WHEN THE MANUFACTURING TECHNOLOGY PROGRAM IS GROWING FASTER THAN THE MANPOWER TO MANAGE IT, CAREFUL CONSIDERATION WILL HAVE TO BE GIVEN TO ANY FUTURE EXPANSION OF OUR ACTIVITIES.

APPENDIX A

METALS SUBCOMMITTEE MEMBERSHIP

METALS SUBCOMMITTEE

Chairman

Mr. Gordon Ney
Manufacturing Technology Division
Industrial Base Engineering Activity
ATTN: DRXIB-MT
Rock Island Arsenal
Rock Island, IL 61299
AV 793-5235, 309-794-5235

Alternate Chairman

Mr. H. A. Johnson
Air Force Materials Lab
ATTN: AFML/LTM
Wright-Patterson AFB
OH 45433
AV 785-2203, 513-225-2203

Army

Mr. George D. Farmer
U.S. Army Mobility Equipment Research & Development Command
ATTN: DRDME-VM
Fort Belvoir, VA 22060

Mr. Irving Betz
U.S. Army Armament Research & Development Command
ATTN: DRDAR-SCM-P
Dover, NJ 07801

Mr. Gerald Gorline
U.S. Army Aviation Research & Development Command
12th & Spruce Streets
St. Louis, MO 63166
AV 698-6476, 314-268-6476

Dr. Vito Colangelo
U.S. Army Armament Research & Development Command
ATTN: Benet Labs, DRDAR-LCB-S
Watervliet, NY 12189
AV 974-5517, 518-266-5517

Mr. Joseph DiBenedetto
Rock Island Arsenal
Engineering Directorate
ATTN: SARRI-ENM
Rock Island, IL 61299
AV 793-4627, 309-794-4627

Mr. Ralph Edelman
U.S. Army Armament Research & Development Command
ATTN: DRDAR-SCM-P
Dover, NJ 07801
AV 880-5811, 201-328-5811

Dr. Robert D. French
U.S. Army Materials and Mechanics Research Center
ATTN: DRXMR-EM
Watertown, MA 02172
AV 995-3578, 617-923-3578

Mr. Roger Gagne
U.S. Army Materials and Mechanics Research Center
ATTN: DRXMR-ER
Watertown, MA 02172
AV 955-3436, 617-923-3436

Mr. Len Luizzi
U.S. Army Armament Research
& Development Command
ATTN: SARWV-RS-AE
Watervliet, NY 12189
AV 794-5507, 518-266-5507

Mr. Sam Goodman
U.S. Army Tank-Automotive
Research & Development Command
ATTN: DRSTA-RKA
Warren, MI 48090
AV 273-1814, 313-756-1814

Mr. Dean Booker
Office of the Project Manager
for Munitions Production Base
Modernization and Expansion
ATTN: DRCPM-PBM-MM
Dover, NJ 07801
AV 880-4084, 201-328-4084

Mr. John Melonas
U.S. Army Missile Command
ATTN: DRDMI-RLM
Redstone Arsenal, AL 35809
AV 746-2810, 205-876-2810

Mr. Albert E. Easterling
Applied Technology Lab
USA Research & Technology Lab
(AVRADCOM)
ATTN: DAVDL-U-TAP
Fort Eustis, VA 23604
AV 927-2400, 804-878-2400

Mr. Robert Coyle
U.S. Army Armament Research
& Development Command
ATTN: DRDAR-LCM-M
Dover, NJ 07801

Mr. Gerald Hall
U.S. Army Armament Readiness
Command
ATTN: DRSAR-IRW
Rock Island, IL 61299
AV 793-5590, 309-794-5590

Navy

Mr. John R. Thompson
Naval Surface Weapons Center
(Code DC-30)
Dahlgren, VA 22448
AV 249-8411, 703-663-8411

Mr. Joseph R. Crisci
David Taylor Naval Ship R&D
Center
(Code 282)
Annapolis, MD 21402
AV 281-2462, 301-267-2462

Mr. Richard Grollo
Naval Ordnance Station
(Code 85)
Louisville, KY 40214

Mr. William T. Highberger
Naval Air Systems Command
(Code 52031D)
Washington, DC 20361

Navy-Continued

Mr. Joseph Bloomer
Naval Ship Engineering Center
(NAVSEA)
Philadelphia Division
Code 6721C
Philadelphia, PA 19112
AV 443-3285, 215-755-3285

Mr. William J. Welsh
Naval Material Industrial
Resources Office
(Code 224)
Philadelphia, PA 19112
AV 443-3991, 215-755-3991

Mr. Howard Miller
NAVAIR 5162C3
Naval Air Systems Command
Washington, DC 20361
AV 222-7640, 202-692-7640

Mr. Joseph Glatz
Naval Air Propulsion Center
Code PE43
P.O. Box 7176
Trenton, NJ 08628
AV 443-7224, 609-882-1414

Mr. Charles Johnson
Naval Weapons Center
Code 3624
China Lake, CA 93555
AV 245-3665, 714-939-3665

Mr. David Henderson
Naval Weapons Engineering
Support Activity
(Code ESA-824)
Washington Navy Yard
AV 288-3753, 202-433-3753

Mr. Gioranni Silvestri
Naval Underwater Systems
Center
Newport Laboratory
Group Code 363012
Newport, RI 02804
AV 948-4032, 401-841-4032

Air Force

Mr. Robert Ondercin
Air Force Materials Laboratory
ATTN: AFML/LTM
Wright-Patterson AFB, OH 45433
AV 785-5151, 513-255-5151

Mr. William Harris
Air Force Materials Laboratory
ATTN: AFML/LTM
Wright-Patterson AFB, OH 45433
AV 785-5151, 513-255-5151

Mr. Fred Miller
Air Force Materials Laboratory
ATTN: AFML/LTM
Wright-Patterson AFB, OH 45433
AV 785-5151, 513-255-5151

Mr. James Lawyer
Mr. George Shearer
Air Force Logistics Command
ATTN: AFLC/MAX

NASA Liaison Representatives

Mr. Jim H. Ehl
Marshall Space Flight Center
Code FSFC/44
Huntsville, AL 35812
205-453-1649

Mr. Charles Blankenship
Lewis Research Center
21000 Brookpark Road
(Code LeRC/433)
Cleveland, OH 44135
216-433-4000, EXT. 6922

Industry

Aerospace Industries Association

Mr. Reed Yount
Manufacturing Technology Lab
Mail Drop E69
Interstate 75
Cincinnati, OH 45215
513-243-2508

Society of Manufacturing Engineers

Dr. Richard Kegg
Manager, Research & Development
The Cincinnati Milacron, Inc.
Research Division
4701 Marburg Avenue
Cincinnati, OH 45209
513-841-8594

American Defense Preparedness Association

Mr. G. B. Barthold
Aluminum Company of America
1600 Harvard Avenue
Cleveland, OH 44105
216-641-3600

Forging Industries Association

Mr. G. B. Barthold
Aluminum Company of America
1600 Harvard Avenue
Cleveland, OH 44105
216-641-3600

American Society for Testing and Materials

Mr. Thomas E. Gregory
Western Electric Co., Inc.
Dept. 316720
3300 Lexington Road
Winston-Salem, NC 27102
919-784-3118

Numerical Control Society

Mr. John C. Williams
11522 Running Cedar
Reston, VA 22091
703-860-5416

APPENDIX B

ATTENDANCE LIST
FOR SUBCOMMITTEE MEETING

23-27 July
East Hartford, CN

NAME	ORGANIZATION	PHONE
John McGovern	NUSC	447-4725
Gordon Ney	DRXIB-MT	793-6586
John Melonas	DRSMI-EAM	746-1902
Giovanni Silvestri	NUSC Newport	948-2617
Fred Miller	AFML/LTM	785-5037
Howard Miller	NAVAIR AIR-5162 C3	222-7640
Michael Redrow	NAVAIR AIR-5162 C313	222-7640
Dean J. Booker	DRCPM-PBM-MC	728-6651
Gerald L. Hall	DRSAR-IRW-T	793-5590
Richard P. Grollo	Naval Ord Station	989-5339
Ted Highberger	NAVAIR AIR-5163 C3	222-7545
Joseph R. Crisci	David W. Taylor Naval Ship R&D Ctr	281-2462
Robert D. French	AMMRC	955-3578
Roger A. Gagne	AMMRC	955-3436
Albert (Gene) Easterling	ATL (AVRADCOM)	927-2771
Robert L. Davies	NASA LeRC Cleveland	(216) 433-4000 x6608
Alan Peltz	DRXIB-MT	793-6586
Irving G. Betz	ARRADCOM-SCM-P	880-6291
Vito Colangelo	ARRADCOM-DRDAR-AE	880-5517
John R. Thompson, Jr.	Naval Surface Wpns Ctr (D213)	249-8105
Eugene Zyblikewycz	NAVMIRO	443-3991
Bill Welsh	NAVMIRO	443-3991
Joe Bloomer	NAVSEC Philadelphia	443-4144
Robert Coyle	ARRADCOM-LCU-M	880-3121
Sam Goodman	TARADCOM	273-1814
Joseph W. Glatz	NAPC PE43	443-7224
Charles A. Johnson	Naval Weapons Center	245-3665
Joe DiBenedetto	SARRI-ENM	793-4584

APPENDIX C

LETTER AND CHARTER
ESTABLISHING GAS TURBINE ENGINE
MANUFACTURING TECHNOLOGY WORKING GROUP

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT 15 May 79

SUBJECT: Gas Turbine Engine Manufacturing Technology Working Group

SEE DISTRIBUTION

1. Reference is made to:

   a. Metals Subcommittee Report, dated December 1978.

   b. Letter, DRXIB-MT, dated 22 December 1978, SAB.

   c. Letter, DRXIB-MT, dated 6 March 1978, SAB.

   d. Letter, DIRSO, dated 18 April 1979, SAB.

2. The Metals Subcommittee has been responsible for forming quite a few joint service projects in the past couple of years. The majority of these efforts have supported turbine engines for aerospace applications. However, turbine engines are increasingly being used in other military hardware. Examples of these commodities, either under development or in procurement, are tanks, high performance ships, and support equipment such as portable electric generators. While the subcommittee has done a good job of coordinating turbine engine related projects for aerospace applications, I feel we have neglected these other commodities. As a minimum, we need to ensure that the information generated from our turbine engine related projects is made more readily available to the MT communities associated with these other commodities. Furthermore, we should be encouraging these MT communities to sponsor needed efforts for turbine engines.

3. I also feel that, while certain segments of our turbine engine MT community are doing an excellant job of interacting with industry, we can do a more effective job by pulling together all segments and collectively interacting with industry.

4. In recognition of the above, the Metals Subcommittee felt that a tri-service working group devoted to turbine engines was required and initiated action to establish such a group. Our initial efforts were aimed at establishing this group under a formal charter approved by the MTAG Executive Committee. However, the Chairman of the MTAG,

DRXIB-MT 15 May 79

Subject: Gas Turbine Engine Manufacturing Technology Working Group

Mr. Charles P. Downer has stated:

> "This group should be formed as recommended to co-ordinate the Tri-Service efforts if there is sufficient evidence that it would be productive and cost effective. The establishment of separate charters for this type of effort is not neccessary as there is sufficient authority in the 31 December 1978 DOD Manufacturing Technology Charter."

5. I believe that the establishment of a working group devoted to turbine engines will prove to be productive and cost effective. Therefore, through this letter, I am establishing the Gas Turbine Engine Manufacturing Technology Working Group. Inclosed is the charter for this group. Mr. Henry Johnson, Chief of the Metals Branch, AFML and Propulsion Focal Point within AFML, has agreed to be its Chairman.

Gordon Ney

1 Incl
as

GORDON NEY
Chairman, Metals Subcommittee

Distribution:
Cdr, WPAFB, ATTN: AFML/LTM, Mr. H.A. Johnson
Cdr, MERADCOM, ATTN: DRDME-VM, Mr. George D. Farmer
Cdr, ARRADCOM, ATTN: DRDAR-SCM-P, Mr. Irving Betz
Cdr, AVRADCOM, ATTN: Mr. Gerald Gorline
Cdr, ARRADCOM, ATTN: Benet Labs, DRDAR-LCB-S, Dr. Vito Colangelo
Cdr, RIA, ATTN: SARRI-ENM, Mr. Joseph Di Benedetto
Cdr, ARRADCOM, ATTN: DRDAR-SCM-P, Mr. Ralph Edelman
Cdr, AMMRC, ATTN: DRXMR-EM, Dr. Robert D. French
Cdr, AMMRC, ATTN: DRXMR-ER, Mr. Roger Gagne
Cdr, ARRADCOM, ATTN: SARWV-RS-AE, Mr. Len Luizzi
Cdr, TARADCOM, ATTN: DRSTA-RKA, Mr. Sam Goodman
PM, Mun Prod Base Mod & Exp, ATTN: DRCPM-PBM-MM, Mr. Dean Booker
Cdr, MIRADCOM, ATTN: DRXMI-RLM, Mr. John Melonas
Cdr, AVRADCOM, Applied Tech Lab, ATTN: DAVDL-U-TAP, Mr. Albert E. Easterling
Cdr, ARRADCOM, ATTN: DRDAR-LCM, Mr. Robert Coyle
Cdr, Naval Surface Wpns Ctr, Code D-213, Mr. John R. Thompson
Cdr, David Taylor Naval Ship R&D Ctr, Code 282, Mr. Joseph R. Crisci
Cdr, Naval Ordnance Station, Code 85, Mr. Richard Grollo
Cdr, Naval Air Systems Command, Code 52031D, Mr. William T. Highberger
Cdr, NAVMIRO, Code 224, Mr. William J. Welsh
Cdr, Naval Air Propulsion Center, Code PE-43, Mr. Joseph Glatz

DISTRIBUTION (Cont'd)

Cdr, Naval Air Systems Command, NAVAIR 52022D, Mr. Howard Miller
Cdr, Naval Ship Engineering Center, Code 6721C, Mr. Joseph M. Bloomer
Cdr, Naval Weapons Center, Code 3624, Mr. Charles Johnson
Cdr, Naval Underwater Sys Ctr, Group Code 363012, Mr. Gioranni Silvestri
Cdr, WPAFB, ATTN: AFML/LTM, Mr. Robert Ondercin
Cdr, WPAFB, ATTN: AFML/LTM, Mr. William Harris
Cdr, WPAFB, ATTN: AFML/LTM, Mr. F. Miller
Cdr, WPAFB, ATTN: AFLC/MAX, Mr. James Lawyer, Mr. George Shearer
Cdr, Marshall Space Flight Ctr, Code FSFC/44, Mr. Jim H. Ehl
Cdr, Lewis Research Ctr, Code LeRC/433, Mr. Charles Blankenship

CF:
Cdr, DIRSO, ATTN: Mr. Burton Bartsch
Cdr, DIRSO, ATTN: Mr. Charles P. Downer

CHARTER

GAS TURBINE ENGINE MANUFACTURING

TECHNOLOGY WORKING GROUP

FUNCTION

Provide technical analysis and coordination of the Manufacturing Technology (Man Tech) projects which support gas turbine engines. Identify improved manufacturing technologies which are of concern and have application to the turbine engines used or anticipated for use by the three Services. Recommend courses of action to:

(1) Establish multi-service programs for common Service needs;

(2) Fill the manufacturing technology gaps in the turbine engine Man Tech plans of the three Services; and

(3) Disseminate technology information resulting from completed or on-going projects.

MEMBERSHIP

The Working Group Chairman will be appointed by the Metals Subcommittee Chairman. A Co-Chairman will be appointed by the Working Group Chairman in consultation with the Metals Subcommittee Chairman. The Working Group membership will be made up of representatives from the organizational elements within the Services having responsibilites for the development and application of manufacturing technology for turbine engines. Members will be selected by the Working Group Chairman in consultation with the Primary Metals Subcommittee Service Representatives. The Working Group Chairman will invite participation from NASA and DOE.

ASSIGNMENT

This Working Group shall be assigned functionally to the Metals Subcommittee; and for reporting and administrative purposes, the Working Group Chairman shall report to the Metals Subcommittee Chairman. Since the manufacturing technologies involved in producing turbine engines extends beyond the responsibilities of the Metals Subcommittee, the Working Group Chairman shall keep the Chairman of other MTAG Subcommittees informed of Working Group activities that affect their areas of concern. Furthermore, the Working Group Chairman will inform and work with other DOD Committees where appropriate.

RESPONSIBILITIES

1. The Working Group is responsible for Technical assessment of all Man Tech projects concerned with materials and processes to be used on turbine engines. Technical assessment shall consist of an examination of the projects for technical worth, compatibility with DOD Man Tech objectives, duplication of effort, and potential for joint interest and funding. The findings shall be documented and made part of the Metals Subcommittee Annual Report.

2. Establish Tri-Service Turbine Engine Manufacturing Technology Roadmaps which show the relationship among R&D, Man Tech, and actual or proposed acquisition of weapons systems. Each roadmap will identify a Man Tech objective, portray all projects that support that objective, show the inter-relationship among projects, display the cost and schedule for each project, and identify the gaps not covered by the projects.

3. Establish a dialogue with industry and solicit their ideas for improving productivity. Work with industry to identify problems and propose solutions.

4. Review recently completed Man Tech efforts and recommend areas for application of the technology.

5. Annually, the Working Group will assess its accomplishments for the year and will identify the tasks to be accomplished for the coming year. This will be incorporated in the Metals Subcommittee Annual Report.

6. Prepare special reports/briefings as required by the Chairman of the Metals Subcommittee or the MTAG Executive Committee.

MEETINGS

The Working Group Chairman will call meetings as required to accomplish the responsibilities listed above. These meetings may take three different forms - full Working Group meetings, special task group meetings, and Working Group/Industry meetings.

Gordon Ney

GORDON NEY
Chairman,
Metals Subcommittee

APPENDIX D

TASKING LETTERS

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: Corona 5

OIC, Naval Air Sys Cmd, Code 52031D, Mr. William T. Highberger
Cdr, WPAFB, ATTN: AFML/LTM, Mr. Robert Ondercin

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the Navy/Air Force investigate the possibility of establishing a joint effort relative to Corona 5. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Ted Highberger of the Navy will have overall responsibility to prepare the plan of action. Mr. Bob Ondercin will act as the primary point of contact for the Air Force.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

for John Petro

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: Small Arms Weapons Manufacturing Technology

Cdr, WPAFB, ATTN: AFML/LTM, Ms Chris Lark
Cdr, ARRCOM, DRSAR-IRW-T, Mr. Larry Butler

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the Army/Air Force investigate the possibility of establishing a joint effort relative to Small Arms Weapons Manufacturing Technology. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Larry Butler of the Army will have overall responsibility to prepare the plan of action. Ms Chris Lark will act as the primary point of contact for the Air Force.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

31 DEC 1979

SUBJECT: Monocrystal Blades

Cdr, WPAFB, ATTN: AFML/LTM, Mr. Carl Lombard
Cdr, USA Research & Tech Lab (AVRADCOM), ATTN: DAVDL-U-TAP, Mr. Jan Lane
Cdr, TARADCOM, ATTN: DRSTA-RKA, Dr. James Chevalier
OIC, Naval Air Sys Cmd, Code 52013D, Mr. Howard Miller

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to Monocrystal Blades. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Carl Lombard of the Air Force will have overall responsibility to prepare the plan of action. Mr. Jan Lane and Dr. Jim Chevalier will act as the primary points of contact for the Army. Mr. Howard Miller will act as the primary point of contact for the Navy.

4. The target completion date for this task should be no later than the end of FY80. Since this task supports turbine engines, and since the metals subcommittee has established the Gas Turbine Engine Manufacturing Technology Working Group, the control of this task will be the working group's responsibility. Therefore, please keep Mr. Henry A. Johnson, chairman of the working group, informed of the major events in the execution of this task.

for John Petrone
GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

31 DEC 1979

SUBJECT: Low Cycle Fatigue Life Improvement for Superalloy Castings

Cdr, WPAFB, ATTN: AFML/LTM, Mr. Ken Kojala
Cdr, USA Research and Technology Lab (AVRADCOM), ATTN: DAVDL-U-TAP, Mr. Jan Lane
OIC, Naval Air Sys Cmd, Code 52013D, Mr. Howard Miller

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to Low Cycle Fatigue Life Improvement for Superalloy Castings. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Jan Lane of the Army will have overall responsibility to prepare the plan of action. Mr. Howard Miller of the Navy and Mr. Ken Kojala of the Air Force will act as the primary points of contact for their respective services.

4. The target completion date for this task should be no later than the end of FY80. Since this task supports turbine engines, and since the metals subcommittee has established the Gas Turbine Engine Manufacturing Technology Working Group, the control of this task will be the working group's responsibility. Therefore, please keep Mr. Henry A. Johnson, chairman of the working group, informed of the major events in the execution of this task.

for R Petrone
GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: HIP of Aluminum Castings

OIC, Naval Air Sys Cmd, Code 52031D, Mr. William T. Highberger
Cdr, WPAFB, ATTN: AFML/LTM, Mr. Ken Kojala

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the Army/Navy investigate the possibility of establishing a joint effort relative to HIP of Aluminum Castings. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Ted Highberger of the Navy will have overall responsibility to prepare the plan of action. Mr. Ken Kojala will act as the primary point of contact for the Army.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

for Jack Petro
GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: Aluminum P/M

Cdr, WPAFB, ATTN: AFML/LTM, Mr. Brian Kosmo
OIC, Naval Air Sys Cmd, Code 52031D, Mr. William T. Highberger
Cdr, Small Caliber Wpns Sys Lab, ATTN: DRDAR-SCM, Dr. Jeffrey Waldman
Cdr, WPAFB, ATTN: AFML Code LLN, Mr. Nate Tupper

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to Aluminum P/M. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Brian Kosmo of the Air Force will have overall responsibility to prepare the plan of action. Mr. Ted Highberger of the Navy and Dr. Jeff Waldman of the Army will act as the primary points of contact for their respective services.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

for GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: P/M Bearings

Cdr, WPAFB, ATTN: AFML/LTM, Ms Chris Lark
Cdr, AMMRC, ATTN: DRXMR, Dr. Paul Fopiano

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the Army/Air Force investigate the possibility of establishing a joint effort relative to P/M Bearings. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Ms Chris Lark of the Air Force will have overall responsibility to prepare the plan of action. Dr. Paul Fopiano will act as the primary point of contact for the Army.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

for Jack Petrov

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT 31 DEC 1979

SUBJECT: Laser Assisted Machining

Cdr, AFML, ATTN: AFML/LTM, Mr. William Harris
Cdr, TARADCOM, ATTN: DRSTA-RKA, Mr. Sam Goodman
OIC, NAVMIRO, Code 224, Mr. William Welsh

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to Laser Assisted Machining. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Bill Harris of the Air Force will have overall responsibility to prepare the plan of action. Mr. Sam Goodman of the Army and Mr. Bill Welsh of the Navy will act as the primary points of contact for their respective sources.

4. The target completion date for this task should be no later than the end of FY80. Since this task supports turbine engines, and since the metals subcommittee has established the Gas Turbine Engine Manufacturing Technology Working Group, the control of this task will be the working group's responsibility. Therefore, please keep Mr. Henry A. Johnson, chairman of the working group, informed of the major events in the execution of this task.

5. The Army is planning an in-house meeting on metal removal in which this subject will also be discussed. The planned participation of the other services in this meeting will offer an initial opportunity to discuss this potentially joint effort.

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: On Line Inspection and Control [illegible]

Cdr, AFML, ATTN: AFML/LTM, Mr. William Harris
Cdr, AVRADCOM, ATTN: DRDAV-EXT, Mr. Gerald Gorline
OIC, NAVMIRO, Code 224, Mr. William Welsh

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to On Line Inspection and Control. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Bill Harris of the Air Force will have overall responsibility to prepare the plan of action. Mr. Gerry Gorline of the Army and Mr. Bill Welsh of the Navy will act as the primary points of contact for their respective services.

4. The target completion date for this task should be no later than the end of FY80. Since this task supports turbine engines, and since the metals subcommittee has established the Gas Turbine Engine Manufacturing Technology Working Group, the control of this task will be the working group's responsibility. Therefore, please keep Mr. Henry A. Johnson, chairman of the working group, informed of the major events in the execution of this task.

5. The Army is planning an in-house meeting on metal removal in which this subject will also be discussed. The planned participation of the other services in this meeting will offer an initial opportunity to discuss this potentially joint effort.

for John Petrop
GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

81 DEC

SUBJECT: High Speed Machining of Aluminum

Cdr, AFML, ATTN: AFML/LTM, Mr. William Harris
Cdr, TARADCOM, ATTN: DRSTA-RKA, Mr. Sam Goodman
OIC, NAVMIRO, Code 224, Mr. William Welsh

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to High Speed Machining of Aluminum. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Bill Harris of the Air Force will have overall responsibility to prepare the plan of action. Mr. Sam Goodman of the Army and Mr. Bill Welsh of the Navy will act as the primary points of contact for their respective services.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

5. The Army is planning an in-house meeting on metal removal in which this subject will also be discussed. The planned participation of other sources in this meeting will offer an initial opportunity to discuss the potentially joint effort.

for John Peters
GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: Automation of Conventional Welding Processes

OIC, David Taylor Naval Ship R&D Ctr, Code 282, Mr. Joseph Crisci
Cdr, TARADCOM, ATTN: DRSTA-RKA, Mr. Sam Goodman
Cdr, AFML/ATTN: AFML/LTM, Mr. Fred Miller

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the three services investigate the possibility of establishing a joint effort relative to Automation of Conventional Welding Processes. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Sam Goodman of the Army will have overall responsibility to prepare the plan of action. Mr. Joe Crisci of the Navy and Mr. Fred Miller of the Air Force will act as the primary points of contact for their respective services.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

1 9 DEC 1979

SUBJECT: Laser Manufacturing Technology Workshop

Cdr, AFML, ATTN: AFML/LTM, Mr. Fred Miller
Officer in Charge, David Taylor Naval Ship R&D Ctr, Code 282, Mr. Joe Crisci
Cdr, TARADCOM, ATTN: DRSTA-RKA, Mr. Sam Goodman
Cdr, USA MICOM, ATTN: DRXMI-RLM, Mr. John Mellonas
Cdr, USA Research & Technology Lab (AVRADCOM), ATTN: DAVDL-U-TAP, Mr. Gene Easterling

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting, it was recommended that the subcommittee consider sponsoring a workshop on Laser Manufacturing Technology. This letter is to follow-up this recommendation by appointing an ad hoc committee to evaluate it. This evaluation should take into account similar technology workshops already planned by others and should consider whether the scope of such a workshop should be expanded to include other similar or competing technologies such as electron beam and plasma arc applications.

3. Mr. Fred Miller of the Air Force will have overall responsibility to conduct this evaluation. Messrs Joe Crisci of Navy and Sam Goodman, John Melonas, and Gene Easterling, all of the Army, will act as primary points of contact within these services.

4. Please keep me informed on a timely basis of the status, and occurance of major events in the execution of this task.

Gordon B Ney

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
Officer in Charge, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

379

DRXIB-MT

SUBJECT: Turbine Engine Seals

Cdr, WPAFB, ATTN: AFML/LTM, Mr. Sylvester Lee
Cdr, USA Research & Tech Lab (AVRADCOM), ATTN: DAVDL-U-TAP, Mr. Jan Lane

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the Army/Air Force investigate the possibility of establishing a joint effort relative to Turbine Engine Seals. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Sylvester Lee of the Air Force will have overall responsibility to prepare the plan of action. Mr. Jan Lane will act as the primary point of contact for the Army.

4. The target completion date for this task should be no later than the end of FY80. Since this task supports turbine engines, and since the metals subcommittee has established the Gas Turbine Engine Manufacturing Technology Working Group, the control of this task will be the working group's responsibility. Therefore, please keep Mr. Henry A. Johnson, chairman of the working group, informed of the major events in the execution of this task.

for John Petro
GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: Limits of Superplastic Forming/Diffusion Bonding Process

OIC, Naval Air Sys Cmd, Code 52031D, Mr. William T. Highberger
Cdr, AFML, ATTN: AFML/LTM, Mr. Shin Inouye

1. Reference is made to the Metals Subcommittee Meeting held in Hartford, CN, 23-27 July 1979.

2. At the referenced meeting it was recommended that the Navy/Air Force investigate the possibility of establishing a joint effort relative to Limits of Superplastic Forming/Diffusion Bonding Process. This letter is to follow up this recommendation by establishing an ad hoc group responsible for developing the appropriate plan of action. This plan of action should include what needs to be done, who will be responsible for what, when tasks should take place, and what and when funds are required.

3. Mr. Shin Inouye of the Air Force will have overall responsibility to prepare the plan of action. Mr. Ted Highberger will act as the primary point of contact for the Navy.

4. The target completion date for this task should be no later than the end of FY80. Please keep me informed of the occurrence of the major events in executing this task.

GORDON B. NEY
Chairman,
Metals Subcommittee

CF:
Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
OIC, NAVMIRO, Code 224, Mr. William Welsh

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

DEC 1979

SUBJECT: Mini-Symposium - 1980 Annual MTAG Meeting

Cdr, AFML, ATTN: AFML/LTM, Mr. H. A. Johnson
Officer in Charge, NAVMIRO, Code 224, Mr. William Welsh

1. Reference is made to the Executive Committee meeting held on 5 Dec 79.

2. At the referenced meeting, it was decided that a mini-symposium for the 1980 Annual MTAG Meeting be held. This letter is to follow-up this decision by appointing an ad hoc committee to plan such a mini-symposium.

3. The writer will assume overall responsibility for the conduct of this task. Mr. Hank Johnson of the Air Force and Mr. Bill Welsh of the Navy will act as the primary points of contact for their respective services.

4. Additional instructions will be forthcoming at a later date.

for GORDON B. NEY
Chairman,
Metals Subcommittee

APPENDIX E

LISTING OF FY80 PROGRAM

ARMY

Project Number	Project Title
E 3717	High Temperature Turbine Nozzle for 10 KW Power Unit
R 1052	Acoustic Emission of Motor Cases
R 3294	Production Processes for Rotary Roll Forming
R 3445	Precision Machining of Optical Components
T 4514	Hard Facing of Track Shoes
T 5024	Gear Die Design and Mfg Utilizing Computer Technology (CAM)
T 5053	Fabrication Techniques for High Strength Ceramics for Diesel Engines
T 5068	New Anti-Corrosive Materials and Techniques
T 5082	Flexible Machining Systems Pilot Line for TCV Components
T 5086	Laser Hardening of Transmission Components
T 5090	Improved and Cost Effective Machining Technology
T 5091	Heavy Aluminum Plate Fabrication
T 5092	Rheocast Pressure Casting for Combat Vehicle Parts
T 5093	High-Speed Machining of TCV Components (Phase I)
T 5097	Integrally Cast Low Cost Compressor
T 6007	Submerged Arc Welding Using Powdered Metals
T 6008	Laser Assisted Machining
T 6053	Welding Systems Integration
1 7036	Isothermal Roll Forging of Compressor Blads
1 7143	Ceramic Gas Seal-High Pressure Turbine

Project Number	Project Title
1 7155	Cost Effective Mfg Methods for Helicopter Gears
1 7197	Fabrication of Integral Rotors by Joining
1 7248	Closed Loop Machining
1 7285	Cast Titanium Compressor Impellar
1 7298	High Temperature Vacuum Carburizing
1 7300	Improved Low Cycle Fatigue Cast Rotors
1 7322	Low Cost Transpiration-Cooled Combustor Liner
1 7326	Electron Beam/Inertia Weld Repair Spline Shafts
1 7362	Engineering Design Handbook for Titanium Castings
1 7366	Spiral Self-Acting Seal
5 1001	Pilot Line for Fuze Fluidic Power Supplies
5 4189	High Fragmentation Steel Production Process
5 4309-10	Forming Tail Fin for APFSDS Projectile
5 4309-11	Forming Boom of Heat Ammo by Upset Forging
5 4309-12	Forming of Stub Base Cartridge Case
5 4369	Techniques to Improve Projectile Cavity Quality
5 4401	Hot Forming and Cold Heading of Fuze Components
5 4402	Improved HSS Precision Gear Hobs
5 6716	Develop Computer-Aided Model of Forming Operations for Artillery Mpts
5 6759	Automatic Transfer-Hot Forming Presses for Mortar Ammo
6 7916	Application of Low Cost Mandrel Materials

Project Number	Project Title
6 7925	Bore Evacuator Boring
6 7927	Generation of Base Machining Surface
6 7928	Robotized Benching Operations
6 7940	Synergistic Platings with Infused Lubricants
6 7948	Establish Cutting Fluid Control System
6 8001	Rapid Flow Plating of Small Caliber Gun Tubes
6 8035	Coating Tube Support Sleeves with Bearing Materials
6 8102	Application of Powder Metallurgy Forging Weapons Components
6 8103	High Velocity Machining
6 8105	Establish Rough Thread Blanks, 8-inch M201 Bushing
6 8106	Large Caliber Powder Chamber Boring
6 8107	Creep Feed Crush Form Grinding
6 8113	Establishment of Ion Plating Process for Armament Parts
6 8117	Shaped Castings of ESR Steel
6 8119	Dimensional Stablization by Vibratory Energy
6 8120	Adaptive Control Technology
6 8135	In-Process Control of Machining
6 8151	Portable Engraving System
6 8152	Improved Anode Straightness for Chromium Plating
6 8153	Increasing Gun Tube Heat Treatment Capacity
6 8162	Improved SC Gun Barrel Rifling Mfg Techniques
6 8163	P/M Steel Preforms for Small Caliber Weapons

Project Number	Project Title
6 8164	High Speed Machining of SC Weapon Components
6 8165	Standards for Diamond Turned Optical Parts
6 8341	Hollow Cylinder Cut Off Machine

NAVY

Project Number	Project Title
DNA00400	Rare Earth Additions to Titanium Alloys
DNA00402	High Toughness Titanium
DNA00700	High Temperature High Strength Laminate
DNA81059	CAM RAM-DS
DNA81062	Monocrystal Turbine Airfoils
DNA81069	Compressor Seal Scale-up
DNA81070	Thermal Barrier Coating Mfg Process
DNA81078	Premium Aluminum Powder
DNS00388	Slag/Flux Weld System
DNS00537	High Frequency Resistance Welding
DNS00547	Warhead Component Fabrication
DNS00551	Picle Battery Fabrication
DNS00564	Heat Exchanger Fabrication
DNS00572	Adjustable Post Mock System
DNS00641	Propellor Blade Straightening Machine
DNS00648	CO2 Blaster
DNS00649	Ultrasonic Wrench Development
DNS00650	Magnetic Forming Machine for Rolling Boiler Tubes
DNS00665	Aluminum MIG Argon-Oxygen Gas Mixture
DNS00666	Multiple Mode Welding System
DNS00667	Metal Treatment Process

AIR FORCE

Project Number	Project Title
01M103	MT for DR Powder Blades
01M130	MT for Effects of Manufacturing Processes on Structural Allowables
01M167	MT for PM Aluminum Plate Production Scale-Up
01M207	MT for Abrasive Blade Tips
01M219	MT for Static Aluminide Components Processing
01M259	MT for Advanced Metal Removal Initiative
01M280	MT for Advanced Metal Removal Techniques
02M145	MT for Large Aluminum Precision Forgings
02M163	MT for Large Titanium Inlet Castings
02M175	MT for High Ductility Aluminum Castings
02M183	MT for Advanced Superalloy PM for Rotating Components
02M184	MT for Mono Crystal Turbine Blade Scale-Up
02M205	MT for Advanced Vane and Combustor Fabrication for Small Engines
02M271	MT for High Speed Machining
02M285	MT for SPFDB TI Components for Small Engines
08M128	MT for WAAM Metal Parts
08M129	MT for 20MM Frangible Projectile Fabrication
11M102	MF for Thermal-Mechanical Processing of Low Cobalt Alloys

Project Number	Project Title
11M103	MT for Scale-Up of PM Bearing Materials
11M107	MT for RQP Disks with LCF Life
11M113	MT for Scale-Up of Non-Cobalt Weldable Alloys
11M121	PM Aluminum Longeron Components
11M122	Low Cost Titanium Wrought Products
11M201	MT for Explosive Fabrication of Engine Components
11M208	MT for Transporation Cooled Airfoils
11M219	MT for Repair of SPF/DB Panels
11M220	Titanium Components for Service Evaluation
11M245	MT for Repair of ODS Components
12M223	MT for Low Cost Advanced Titanium Body Structures
12M224	MT for Low Cost Titanium Propellant Tank
18M134	MT for Tubular Projectiles
18M139	MT for Hard Structure Munition Warhead
18M237	MT for Plasma Sprayed Band Seats
71M148	MT for HP DS Futectic Blade Fabrication
72M730	MT for Ceramic Engine Components
91M116	High Strength PM Aluminum Mill Products
91M128	MT for Rolling High Temperature Sheet
91M204	MT for Innovative Low Cost Tooling
92M204	MT for Integral Rotating Components by Isothermal Forging

APPENDIX F

LISTING OF FY81 PROGRAM

ARMY

Project Number	Project Title
E 3717	High Temperature Turbine Nozzle for 10 KW Power Unit
R 1018	Improved Manufacturing Processes for Dry Tune Accelerometers
R 3294	Production Processes for Rotary Roll Forming
R 3445	Precision Machining of Optical Components
T 4586	Improved Large Armor Steel Castings
T 5002	Fabricating Torsion Bar Springs from High Strength Steel
T 5006	Production of Lightweight Steel Cast Trach Shoes
T 5007	Advanced Technology Brake Lining Materials
T 5054	Laser Surface Hardened Combat Vehicle Components
T 5068	New Anti-Corrosive Materials and Techniques
T 5080	Fabrication Methods for High Strength Net Shape Aluminum Transmission Cases
T 5081	Fabrication of Friction Rings and Reaction Plates
T 5082	Flexible Machining Systems Pilot Line for TCV Components
T 5088	High Power Electron Beam Welding
T 5090	Improved and Cost Effective Machining Technology
T 5091	Heavy Aluminum Plate Fabrication
1 7052	Ultrasonically-Assisted Cold Forming of Titanium Nose Caps
1 7155	Cost Effective MFG Methods for Helicopter Gears

Project Number	Project Title
1 7197	Fabrication of Integral Rotors by Joining
1 7199	Surface Hardening of Gears Bearing and Seals by Lasers
1 7240	Machining Methods for ESR 4340 Steel Helicopter Applications
1 7241	Hot Isostatic Pressed Titanium Castings
1 7285	Cast Titanium Compressor Impellar
1 7286	High Quality Superalloy Powder Production for Turbine Components
1 7291	Titanium Powder Metal Compressor Impeller
1 7298	High Temerature Vacuum Carburizing
5 1001	Pilot Line for Fuze Fluidic Power Supplies
5 1903	Die Cast Tailcone and Design Machine for Blu-96/B
5 4184	For Sabot Segments to Net Shape on APFSDS Ammo
5 4189	High Fragmentation Steel Production Process
5 4309-08	Processes for Economical Fabrication of Body for APDS Ammunition
5 4309-09	Investigate Methods for Forming and Heat Treating the Core
5 6738	Ultra High Speed Metal Removal, Artillery Shell
6 3901	Manufacture of Fluidic Amplifiers by Cold Forming
6 7605	Chemically Bonded Sand for Close Tolerance Casting
6 7730	Manufacture of Split Ring Breech Seals
6 7920	Conservation of Critical Materials for Gun Tubes

Project Number	Project Title
6 7925	Bore Evacuator Boring
6 7926	Hot Isostatic Pressing of Large Ordnance Components
6 7927	Generation of Base Machining Surface
6 7928	Robotized Benching Operations
6 7940	Synergistic Platings with Infused Lubricants
6 7948	Establish Cutting Fluid Control System
6 7985	Small Arms Weapons New Process Production Technology
6 8001	Rapid Flow Plating of Small Caliber Gun Tubes
6 8004	Co-Deposition of Solid Lubricants During Anodizing
6 8024	High Speed Abrasive Belt Grinding
6 8026	Application of Synthetic Quenchants to Gun Tubes and Heavy Weapon Components
6 8035	Coating Tube Support Sleeves with Bearing Materials
6 8047	Pass Thru Steady Rests for Tube Turning
6 8050	Recycling Spent Gun Tubes by ESR Melting
6 8057	Dual Rifling Broach Removal System
6 8059	Salvage of Cannon Components by Electrodeposition
6 8105	Establish Rough Thread Blanks, 8-inch M201 Bushing
6 8106	Large Caliber Powder Chamber Boring
6 8107	Creep Feed Crush Form Grinding
6 8208	Material Handling
6 8341	Hollow Cylinder Cut Off Machine
6 8342	Keyway Milling Machine

NAVY

Project Number	Project Title
DNA00400	Rare Earth Additions to Titanium Alloys
DNA00402	High Toughness Titanium
DNA00651	High Production Fluidic Circuit Manufacture
DNA00703	Critical Aircraft Bearing Refurbishment
DNA00744	HIP of Aluminum Castings
DNA00746	High Strength INCO 718 Castings
DNA00747	Corrosion Resistant Turbine Blade Tips
DNA00752	Manufacture of Curved Cooling Holes
DNS00274	Computerized Welding
DNS00591	Mechanized Material Application
DNS00635	Hull Access Holes Automatic Cutting
DNS00638	Automatic Plasma Arc Cutting Machine
DNS00646	Hydraulic System Overhaul
DNS00651	Material Handling
DNS00673	Battery Grid Casting
DNS00687	Dissimilar Metal Pipe Penetrators
DNS00693	Low Cost Machined Optics

AIR FORCE

Project Number	Project Title
C701	MT for Manufacturing Cost/Design Guide
C810	MT for Sheet Metal Cell Demonstrations
T1M184	MT for Production of Large Near-Net Titanium PM Parts by HIP
T1M189	MT for Advanced TL Powder Production
01C805	MT for Optimal Sheet Metal Center Design
01C809	MT for Optimal Sheet Metal Machine Designs and Transition
01M103	MT for DR Powder Blades
01M121	Premium Turbine Wheel Castings
01M125	MT for Joining of PM Disks
01M130	MT for Effects of Manufacturing Processes on Structural Allowables
01M167	MT for PM Aluminum Plate Production Scale-Up
01M206	MT for Production Scale-Up of 2500 F Seal System
01M207	MT for Abrasive Blade Tips
01M219	MT for Static Aluminide Components Processing
01M242	MT for Application of SPF/DB Titanium Fabrication
01M259	MT for Advanced Metal Removal Initiative
01M279	MT for Vacuum Plasmo Spray Overlay Coatings
01M280	MT for Advanced Metal Removal Techniques
02M145	MT for Large Aluminum Precision Forgings
02M163	MT for Large Titanium Inlet Castings
02M172	MT for Injection Molded Columbium Combustors

Project Number	Project Title
02M175	MT for High Ductility Aluminum Castings
02M183	MT for Advanced Superalloy PM for Rotating Components
02M184	MT for Mono Crystal Turbine Blade Scale-Up
02M205	MT for Advanced Vane and Combustor Fabrication for Small Engines
02M237	MT for TI MX Shroud
02M271	MT for High Speed Machining
02M285	MT for SPFDB TI Components for Small Engines
08M128	MT for WAAM Metal Parts
08M129	MT for 20MM Frangible Projectile Fabrication
71M148	MT for HP DS Futectic Blade Fabrication
71M169	Aluminum PM for Precision Parts
71M233	MT for Producibility of High Temp TI Alloy French Connection
71M868	MT for Superalloy Engine Ring Rolling
81M110	MT for Manufacturing Scale-Up of Cold Formable TI Sheet
81M158	MT for Improved Superalloy Powder Production
81M208	MT for Production Demonstratinn of A-10 Weldbond
81M212	MT for Mccraly Coating Process Scaleup
81M261	MT for Machine Tool Task Force
91C701	MT for Unified Sheet Metal Model
91M116	High Strength PM Aluminum Mill Products
91M124	MT for Improved Superalloy Powder Production
91M128	MT for Rolling High Temperature Sheet

Project Number	Project Title
91M167	MT for Process Effects on Aluminum Casting Allowables
91M204	MT for Innovative Low Cost Tooling
98M126	MT for Low Cost 20MM Cartridge Cases
98M181	MT for Low Cost 20MM Cartridge Case Testing

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